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ALCYONARIA OF THE CAPE OF GOOD HOPE
AND NATAL.

I.—ALCYONACEA.

INAUGURAL-DISSERTATION ZUR ERLANGUNG DER DOCTORWÜRDE
DER HOHEN PHILOSOPHISCHEN FAKULTÄT
DER UNIVERSITÄT BERN

VORGELEGT VON

J. STUART THOMSON

AUS EDINBURG.



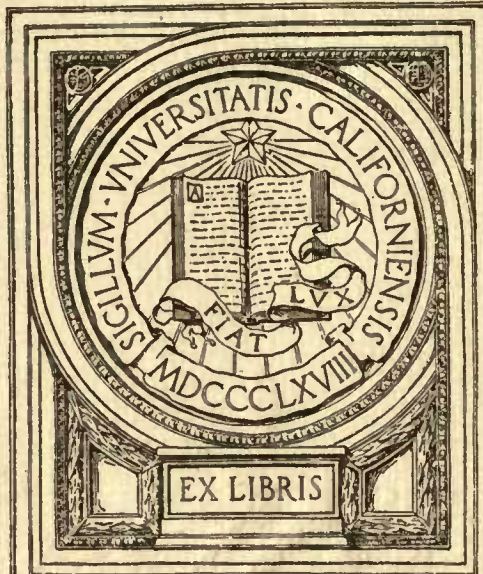
Auf Antrag von Herrn Professor Dr Studer von der philosophischen Fakultät der
Universität Bern angenommen.

10 November 1909.

Der Dekan:

Prof. Dr. MÜLLER-HESS.

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XIX.—The Alcyonaria of the Cape of Good Hope and Natal. Alcyonacea.
By J. Stuart Thomson, Ph.D., F.L.S. (With Four Plates.)

(MS. received January 10, 1910. Read January 10, 1910. Issued separately September 21, 1910.)

The following is the first of a series of papers which I intend to issue on South African Alcyonaria. During a lengthened residence at the Cape of Good Hope, I devoted special attention to the Alcyonaria collected on board the Government steam trawler *Pieter Faure*. Professor HICKSON has contributed two papers on Cape Alcyonarians to the volumes *Marine Investigations in South Africa*; but since then a large number of forms have been dredged, and there still remain in the collection entrusted to me many unidentified and undescribed species. In this first instalment I have confined myself to the Alcyonacea. The present work has been carried on in the Zoological Institute and Museum of Natural History, Berne, and it would be difficult to overstate my indebtedness to Professor STUDER, who, besides giving me much valuable advice, stimulus, and encouragement, placed the entire literature of the subject at my disposal.

I have also to express my indebtedness to Professor J. D. F. GILCHRIST, Cape Town, who on my return to Europe entrusted this collection to me for report. This and other extensive collections were made under the auspices of the Cape Government, whose servant I was for a term of several years.* The photographs were taken in the Zoological Institute, Berne, and for help with these I have to thank Dr F. BAUMANN, assistant in that department. Professor HICKSON has already given a summary of the species previously recorded from South Africa, and I hope to deal more fully in a later paper with the distribution of Alcyonaria on the coast of Cape Colony and Natal.

The species described in the present paper are as follows:—

Bellonella studeri, n. sp. From St Francis Bay, near Port Elizabeth, 23–25 fathoms, p. 550.

Bellonella rubra, Brundin. (Locality not recorded), p. 554.

Metalcyonium clavatum, Pfeffer. From Umhloti river mouth, 40 fathoms, and Tongaati river mouth, 36 fathoms, (Natal), p. 556.

Metalcyonium natalensis, n. sp. From Umhloti river mouth, 39–40 fathoms, (Natal), p. 559.

* I also received a grant of £20 towards the expenses of this paper from the South African Association for the Advancement of Science.

Metalcyonium patagonicum, May.

1. Off Sandy Point, 51 fathoms.
2. Off Cape Morgan, near East London, 77 fathoms.
3. Off Tugela river mouth, 65-70 fathoms, (Natal).
4. Off Amatikulu river mouth, 62 fathoms, (Natal), p. 562.

Alcyonium purpureum, Hickson. Between Roman Rock and Cape Recife, Kalk Bay; Gordon's Bay, etc. This is a common littoral form, p. 566.

Alcyonium fauri, n. sp. Off Cape St Blaize, near Mossel Bay, 36 fathoms, p. 568.

Alcyonium pachyclados, Kl.

1. Off Gonubie River (near East London), 20 fathoms.
2. Off Algoa Bay, etc., p. 570.

Alcyonium rotiferum, n. sp. Off Kuskamma Point, 33 fathoms, p. 573.

Capnella rugosa, Kükenthal. Off Gonubie River (near East London), 20 fathoms, p. 575.

Capnella gilchristi, n. sp. Off Cape Morgan, 47 fathoms, p. 578.

Eunephthya thyrsoides, Verrill. Off Cape Morgan (north of East London), 45 fathoms, p. 580.

Malacacanthus rufus, n. gen. et sp. Off Seal Island, False Bay, 11 fathoms, p. 583.

Bellonella studeri, n. sp.

Plate I. fig. 1; Pl. III. fig. 23; Pl. IV. figs. 45 a-e.

The colony consists of a basal supporting trunk, and a more or less cone-shaped upper portion bearing numerous polyps. The entire colony measures in millimetres 92 by 41; the polyp-bearing part, 52 by 41; the basal trunk, 42 by 36. The trunk is broadest at the base, and tapers slightly towards the polyp-bearing portion of the colony. It has a fairly strong and tough consistency externally, and its surface is marked by longitudinal lines or grooves. These grooves measure from 0.5 to 1.0 mm. in breadth. The trunk is of a brownish-red colour, and is clearly differentiated from the polyp-bearing part. The upper portion of the colony is somewhat flattened and shows numerous polyps, extended and retracted, scattered irregularly over its entire surface. The predominant colour of this part is red, but the polyps show some colour differentiation. The tentacles have red triangular stripes or bands beneath, but are yellow apically. The greater part of the polyp is transparent, but the walls of the stomodæum are red. The calyx is marked by eight red, triangular bands or stripes. These colours are in all cases due to the spicules. The polyps are separated from one another by intervals of coenenchyma, the interval between two being from 1 to 2 mm. They are completely retractile, and thus in the retracted state, the calyx covers the entire polyp. The upper part of the calyx is fairly soft, and the entire calyx is never completely retractile. On retraction, the tentacles are rolled up and the pinnules inverted.

In the single specimen upon which this description is based, only one polyp was sufficiently expanded to show the tentacles completely extended. It possessed the following dimensions:—Length of entire polyp including calyx, 12 mm.; length of crown and tentacles, 5.3 mm.; diameter of spread of tentacles about 6 mm.; length of stomodæal part, 4.6 mm.; length of part containing the mesenterial filaments, 7.2 mm.; length of calyx, 4 mm.; diameter of calyx, 4 mm. The measurements of a polyp, the tentacles of which were partially retracted, were in the mounted condition as follows:—Length of polyp including calyx, 11 mm.; length from apex of stomodæum to base of calyx, 9.5 mm.; length of stomodæum, 3.8 mm.; length of part containing the mesenterial filaments, 3.2 mm.; length of calyx, 3 mm.

The polyps were well preserved, and thus their structure was readily ascertained. The general form of the polyp is that of a more or less octagonal tube, which expands at the apex into a crown and eight tentacles, and at the base into a wider portion, the calyx.*

The polyp is differentiated into the following parts:—

1. The crown, consisting of the tentacles and adjacent parts. This region is provided with spicules in the form of long spindles, red and yellow in colour. These spicules are arranged *en chevron* on the tentacles in eight triangular stripes, and around the base of the latter they form a ring. These triangular stripes of spicules are pointed apically. In each tentacle, there are about eighteen pinnules which have the nematocysts arranged in about eight rings or zones transverse to the long axis.

2. The stomodæal region. This shows spicules of two kinds: (*a*) long spindles externally, and (*b*) short, broad, spinous spindles internally in the walls of the stomodæum itself. Spicules of the latter shape also apparently form a ring round the basal opening of the stomodæum. The spicules within the stomodæal wall (proper) are arranged so that in the periphery their long axes are perpendicular to the longitudinal wall; internally, they have their long axes parallel to that layer.

3. The part of the polyp containing the mesenterial filaments which has few spicules.

4. The calyx. This is strengthened by numerous small spicules, which are arranged *en chevron* in eight triangular bands or stripes resembling the distribution of spicules on the tentacular region.

The tentacles, and even the pinnules, possess minute, yellow, irregular spicules measuring 0.085 mm. in length by 0.165 mm. in breadth. Transverse sections through the stomodæal portion of the polyp show the muscles arranged on the mesenteries in the manner characteristic of Alcyonaria, but the muscles in this species are feebly developed. The siphonoglyphe or sulcus shows the presence of cilia very clearly. The cavities of the polyps are directly continued into long canals which pass down through the coenenchyma to the base of the trunk. The central part of the trunk is of much softer consistency than the more external part, being almost gelatinous. The rind of the

* I have retained the use of the term *calyx* throughout this work, although I am aware that another term has been extensively adopted.

trunk shows numerous small spicules, but in the central part they are fewer in number, and of a different form.

Spicules occur in the tentacles and crown, in the stomodæal walls and around the upper portion of the latter, in the calyx and in the trunk. These several parts are marked either by different forms of spicules, or by spicules of different dimensions. The crown and tentacles show long spindles, usually red in colour, yellow also occurring, but not so abundantly. These spicules are, as previously stated, disposed *en chevron*, a triangular stripe on each tentacle; at the base of the tentacles, these spindles are arranged so as to form a ring encircling the polyp. The spicules of the crown and tentacles show the following dimensions:—0·49 by 0·05 mm. to 0·75 by 0·06 mm., and 0·53 by 0·03 mm. to 0·56 by 0·07 mm. The spicules in the walls of the stomodæum (proper) are short, broad, spinous spindles, the latter have the following dimensions:—0·09 by 0·03 to 0·14 by 0·05 mm. The more external spicules surrounding the stomodæal part of the polyp are similar to those of the tentacles and crown.

The spicules from the external part of the calyx resemble in form those of the stomodæal wall (proper); the former are arranged *en chevron* in eight triangular stripes or bands resembling so far the arrangement on the tentacles, but the stripes or bands are connected with one another by a few intervening spicules. On retraction of the polyp within the calyx, the distribution of the calyx spicules gives rise to a star-like appearance. These spicules have the following dimensions:—0·09 by 0·04 mm. to 0·14 by 0·06 mm. The spicules of the internal part of the calyx wall are, on the contrary, long narrow spindles or rods resembling those of the tentacles, but their outline is slightly straighter, and they are colourless. Their dimensions are as follows:—0·50 by 0·03 to 0·75 by 0·03 mm.

The distribution of the spicules in the trunk is noteworthy. They are very numerous in the external part of the coenenchyma or rind, but on the contrary only a few occur in the central portion of the same, and are of a different form from those of the exterior. The spicules of the rind are double spindles, and have the following dimensions:—From 0·11 by 0·08 to 0·16 by 0·09 mm.

The spicules of the central trunk are narrow, spinous spindles, and have the following dimensions:—From 0·15 by 0·02 to 0·30 by 0·06 mm., and from 0·15 by 0·02 to 0·20 by 0·08 mm.

The spicules of the colony may be briefly summarised as follows:—

1. Long narrow spindles from the crown and tentacles of the polyp, frequently slightly curved; colour, red and yellow.
2. Short and broad, spinous spindles from the walls of the stomodæum (proper) and from the external part of the calyx wall; colour, red.
3. Long spindles or rods from the internal part of the calyx wall; colourless.
4. Double spindles from the external coenenchyma of the trunk.
5. Spinous spindles from the central coenenchyma of the trunk.

The characteristics of this species are distinct and well marked. In several of its features it seems to stand near *Bellonella variabilis*, Studer, and *Nidalia arctica*, Dan. It shows, however, obvious differences from both these species, as in the latter the polyp-bearing part of the colony is slightly branched, whereas in *Bellonella studeri* the polyps stand free and are separated by small intervals of coenenchyma. It also differs from these species in the arrangement of the spicules. The arrangement of the spicules in the polyps of *Bellonella studeri* is somewhat similar to that of *Nidalia* (*Bellonella*) *rubra*, Brundin, but in the general form and in the shape of the spicules, there are wide differences. It differs from *Bellonella rigida*, Brundin, in having a much plumper form, in the polyps being separated from one another by small intervals of coenenchyma, and in other characteristics.

One must here refer to the changes introduced by KÜKENTHAL in the nomenclature and systematic position of these and allied forms. KÜKENTHAL regards GRAY's genera *Bellonella* and *Nidalia* as equivalent, and uses the name *Nidalia*. He is convinced that two different genera are contained in the genus *Nidalia* (*Bellonella*), and that some species belong to the family Alcyonidæ, while others should be classed as Nephthyidæ. Under the family Alcyonidæ he constitutes a new sub-family, viz. the Nidalinae, of which the most important characteristics are as follows :—The colony is unbranched; the upper part of the polyp can be withdrawn within a retractile calyx, and the gastral cavities of the polyps stand in direct communication with one another. In this sub-family he places two genera : *Nidalia*, Gray, em. Kükenthal, and *Nidaliopsis*, Kükenthal. His diagnosis of the genus *Nidalia* is as follows :—

The colony is unbranched, rarely cleft, and consists of a sterile stalk and a sharply differentiated conical or cylindrical polyp-bearing part. The upper part of the polyp is soft-walled, and retractile within a non-retractile calyx. There is no dimorphism. The polyps are generally continued to the base in wide gastral spaces containing mesenteries. The communication between the polyps is partly direct by transverse canals, partly indirect by an endodermal canal network. The spicules are mostly thorny ("bedornnte") rods and spindles.

KÜKENTHAL holds that the following species belong to the genus *Nidalia* as emended by him :—*Nidalia occidentalis*, Gray; *N. granulata*, Gray; *N. rubra*, Brundin; *N. cinerea*, Brundin; *N. rigida*, (= *Eleutherobia japonica*, Putter) and *N. indica*, Thomson and Henderson. Further, that the following do not belong to *Nidalia* but to the genus *Gersemia*, Marenz, em. Kükenthal :—*N. foliacea*, Ung; *C. bocagei*, Kent; *C. studeri*, v. Koch; *Bellonella variabilis*, Studer, and *Nidalia arctica*. More recently he has removed *Nidalia foliacea* to the genus *Capnella*. KÜKENTHAL's diagnosis of the genus *Gersemia*, in his monograph on *Japanese Alcyonaceen*, 1906, differs slightly from that contained in his *Versuch einer Revision der Alcyonarien. II. Die Familie der Nephthyiden*, 1907. His later diagnosis is as follows :—
"Nephthyiden ohne Stutzbündel, die Polypen stehen nicht in Läppchen oder Bündeln, sondern einzeln. Der Aufbau der Kolonien ist baumförmig, doch können die Aeste

rudimentär werden. Die Polypen haben einen scharf gesonderten nicht retractilen Kelch aufzuweisen, in welchen der obere Teil zurückziehbar ist."

Regarding KÜKENTHAL's revision and emendations there are elements of doubt as to whether Gray's genera *Nidalia* and *Bellonella* are really identical, and that the genus *Gersemia* as amended by KÜKENTHAL has little in common with the original diagnosis as given by MARENZELLER, and whether certain species included by him under this genus should really be placed there.

As there does not exist a very complete knowledge of the anatomy of some of the forms included under the name *Nidalia* or *Bellonella*, and as the systematic position of these forms appears to be in a state of transition as shown even in the progressive stages of KÜKENTHAL's own work, I prefer to wait for further investigation. I place my species among the Alcyonidæ rather than as belonging to the Nephthyidæ. The characters of this form are so well marked as to render detailed comparison with allied forms unnecessary.

Locality, etc. :—"Pieter Faure," No. 18,831. St Francis Bay, Noors Kloof Point, N.W. by W. $\frac{1}{4}$ W. to N.W. by W. $\frac{1}{2}$ W. 8-12 miles. Depth, 23-35 fathoms. Nature of bottom, fine sand and mud.

Bellonella rubra, BRUNDIN.

Plate II. fig. 13; Pl. III. figs. 21 a-c; Pl. IV. fig. 43.

This description is based on four specimens in all of which the polyps were almost completely retracted. At first I thought that these were retracted specimens of *Metalcyonium clavatum*, Pfeffer, but on closer examination they showed important differences.

The following measurements were taken :—

| | Specimen A. | Specimen B. | Specimen C. | Specimen D. |
|---|-------------|-------------|-------------|-------------|
| Length of entire colony, | 44·8 mm. | 33·5 mm. | 22·0 mm. | 21·0 mm. |
| Length of trunk, | 24·0 " | 16·0 " | 7·0 " | 12·0 " |
| Breadth of trunk at middle, | 11·0 " | 11·0 " | 13·0 " | 6·5 " |
| Length of polyp-bearing part, | 20·8 " | 17·5 " | 15·0 " | 9·0 " |
| Length of polyp-bearing part at middle, | 10·0 " | 8·8 " | 12·0 " | 6·5 " |

The surface diameter of contracted polyps is about 2 mm. The distance of polyps from one another is about 2 mm.

The colonies are of a light crimson-rose colour, the polyp-bearing part having a deeper colour than the trunk, which is sometimes almost white. The general shape of the colony resembles that of a cut or lopped trunk of a tree, but with a rounded apex. The base of the trunk sometimes expands into processes for attachment. Longitudinal and transverse grooves sometimes occur on the surface of the trunk.

The polyps have no definite arrangement, but are irregularly scattered on the surface of the coenenchyma. When contracted, they appear as yellowish and reddish circular areas (calyces) on the surface of the deep red coenenchyma. The upper part of the polyp is thus almost completely retractile, but this is apparently not the case with the calyx. Observation of a less retracted polyp shows the upper parts of eight tentacles, each with its band of red spicules. External to these is a double circular band of small red spicules, the calyx. On slight dissection, the crown of the polyp can be pushed out of the cavity, and is seen to be fairly similar in structure to that of *Metalcyonium clavatum*, Pfeffer (see p. 556). On retraction, the tentacles are simply drawn down into the stomodæal cavity, but are not inverted. The condition is thus similar to that in *Alcyonium digitatum*. None of the polyps were in a completely expanded condition. Gonads were not developed. The calyx is not a wart-like projection of the rind of the coenenchyma as in *Metalcyonium clavatum*.

A rough transverse section through the polyp-bearing part shows that the rind is provided with numerous short, broad spindles; internally to these, there are long spindles and clubs usually directed radially and also grouped round the canals. The tissue of the coenenchyma is very largely developed, the canals being small.

The texture of the trunk is very compact and tough; the canals appear to be the direct continuation of those in the upper coenenchyma; the spicules are extremely numerous. The rind especially possesses a very large number of spicules, which are densely crowded together. The long spindles and clubs found in the upper portion of the colony are not, as a rule, found in the trunk.

The spicules of the crown and tentacles are long, narrow spindles with small projections, and clubs with larger processes. Their colour is red. They are disposed much in the same manner as in *Metalcyonium clavatum* (see p. 558), but are larger. Their dimensions are as follows:—From 0·21 by 0·05 to 0·67 by 0·06 mm., and from 0·47 by 0·035 to 0·40 by 0·10 mm.

The spicules of the calyx are short, broad spindles, red in colour. They measure as follows:—From 0·09 by 0·07 to 0·17 by 0·05 mm., and from 0·17 by 0·05 to 0·15 by 0·08 mm.

The spicules of the internal trunk are short, broad spindles, and measure from 0·09 by 0·04 to 0·19 by 0·11 mm.

The spicules from the rind of the trunk are short, broad spindles, and have the following dimensions:—From 0·09 by 0·06 to 0·28 by 0·12 mm.

The long spindles from the internal coenenchyma of the polyp-bearing part measure from 0·255 by 0·034 to 0·408 by 0·0425 mm.

The club-shaped spicules from the same part measure approximately 0·17 by 0·051 mm.

My specimens agree well with BRUNDIN's description of *Bellonella rubra*. BRUNDIN's specimens were from the Straits of Korea and Tsugar, Japan. KÜKENTHAL has also recorded this species under the name *Nidalia rubra*, Brundin, from Sagami Bay,

Japan. KÜKENTHAL gives as the most important difference between *Nidalia* and *Metalcyonium*, that in the former the gastral cavities of the polyps are in direct connection with one another by means of transverse canals, while in the latter communication is only indirect through an endodermal network. The latter fact appears to be true for those species of *Metalcyonium* which I have recorded, but I fail to see that in all those species which he regards as *Nidalia* the contrary holds.

Metalcyonium clavatum, Pfeffer.

Plate I. fig. 7; Pl. II. fig. 9; Pl. III. figs. 17 and 19; Pl. IV. figs. 35-37.

This description is based on four well-preserved specimens, with the polyps in varying states of expansion. Each specimen consists of a basal supporting trunk and an approximately cylindrical polyp-bearing portion. The following dimensions were noted:—

| | Specimen A (P.F. 10,881). | Specimen B (P.F. 10,948A). | Specimen C (P.F. 10,948A). |
|--|------------------------------|-------------------------------|-------------------------------|
| Length of entire colony, | 46 mm. | 55 mm. | 18 mm. |
| Length of trunk, | 17 " | 28 " | 10 " |
| Breadth of trunk, | 06·8 " | 08·0 " | 05·0 " |
| Length of polyp-bearing part of colony, . | 29·0 " | 28·7 " | 8·5 " |
| Breadth of polyp-bearing part of colony, . | 13·0 " | 10·5 " | 5·8 " |

The trunk expands slightly at the base, and in some cases fixes itself around organic objects such as polychæt tubes. The consistency of the trunk is extremely soft, and its surface is marked by longitudinal lines and sometimes by transverse wrinkles; its colour is rose, slightly paler than the ground-colour of the polyp-bearing portion. The latter shows numerous polyps, mainly colourless, but they are provided with eight bands of red-and-yellow spicules in the tentacular part, and a few encircling spicules at the base of these. The polyps are arranged in longitudinal but not straight ridges, each of the latter being bordered laterally by lines separating it slightly from the adjacent one. The polyps were almost completely retracted within the calyx.

Well-expanded polyps showed the following structure:—

1. An upper part (the crown), consisting of the tentacles and containing the upper portion of the stomodæum. This part is slightly broader than the succeeding part. It shows the usual eight pinnate tentacles and eight bands of spicules (mostly red in colour) arranged *en chevron*. There are a few encircling spicules at the base of these longitudinal bands. The number of pinnules in each tentacle ranges from about eight to twelve.

2. The median portion of the polyp, containing the greater portion of the stomodæum. This part has no spicules either internally or externally. It has longitudinal and transverse lines.

3. The basal part of the polyp, containing the lowermost part of the stomodæal tube and the mesenterial filaments, is protected externally by a much projecting calyx with numerous red spicules. It was not clear whether the calyx could be retracted or not.

The following are the dimensions of a fairly expanded polyp:—

- | | | |
|---|-----------|----------|
| 1. Length of upper part (crown) from tip of tentacles to base of encircling band of spicules, | | 2.40 mm. |
| 2. Breadth of same at middle, | | 1.50 „ |
| 3. Diameter of spread of tentacles, | | 1.20 „ |
| 4. Length of median (stomodæal) part, | | 1.20 „ |
| 5. Breadth of same at middle, | | 1.45 „ |
| 6. Length of calyx, | | 1.00 „ |
| 7. Breadth of calyx at middle, | | 1.25 „ |

The following are the dimensions of a fairly retracted polyp:—

- | | | |
|----------------------------|-----------|----------|
| 1. Length of upper part, | | 1.25 mm. |
| 2. Breadth of upper part, | | 2.60 „ |
| 3. Length of median part, | | 1.10 „ |
| 4. Breadth of median part, | | 1.75 „ |
| 5. Length of calyx, | | 1.00 „ |

Transverse sections through the stomodæal part show that the muscles are very well developed, that the wall of stomodæum (proper) is thick, and that the siphonoglyphe is provided with cilia. In one of the specimens (P.F. 10,881) female gonads were conspicuously developed on the lower mesenteries of the polyp, and in the intermesenterial cavities of the stomodæal region a number of eggs were observed (Pl. III. fig. 19). The other specimens did not show gonads. A characteristic feature is that the lower portion of the polyp lies within and is protected by a much projecting calyx, which appears to be more of the nature of an outgrowth of the outer rind than a part of the polyp itself. Sections show that the uppermost part of this outgrowth or calyx surrounds the lower part of the stomodæum, but that the greater portion is occupied by that part of the polyp in which the mesenterial filaments are situated. The walls of this cavity vary in thickness: in the upper part it is one-layered, in the lower part two-layered. The greater part of the polyp can be retracted within this cavity.

The cavities of the polyps are continued into long canals passing down through the coenenchyma of the trunk. These canals are large, numerous, and conspicuous. The canals are not in direct communication with one another. The canals in the outer part of the trunk are slightly smaller than those of the interior. The outer part of the trunk has a tougher consistency than the centre, and the spicules are more crowded together. Specimen (No. 10,881) showed gonads developed on the walls of the canals of the trunk. The other specimens did not show these.

The spicules of the polyps and of the trunk are mostly spindles. The tentacles and upper part of the polyp have long spindles with short processes. These spindles are mostly red in colour, but yellow ones occur at the apices of the tentacles. These spicules are disposed *en chevron* in eight triangular stripes or bands and in an encircling basal ring. The spicules of this part have the following dimensions:—0·15 by 0·04 to 0·32 by 0·05 mm. The spicules of the calyx are much shorter and broader spindles. They are all red in colour, and are very abundant. They have the following dimensions:—From 0·08 by 0·04 to 0·12 by 0·06 mm.

A rough section through the polyp-bearing part shows numerous, usually long spicules towards the outside, only a few occurring nearer the centre. The spicules of the internal trunk are clubs and spindles, and differ slightly from those situated more externally. Those of the external trunk approach more nearly in shape to those of the polyps. There are apparently two kinds, long and short. The spicules of the external trunk have the following dimensions:—From 0·07 by 0·04 to 0·17 by 0·10, and from 0·25 by 0·08 to 0·28 by 0·10 mm. The spicules of the internal trunk measure as follows:—From 0·14 by 0·06 to 0·17 by 0·08 mm., and from 0·14 by 0·06 to 0·15 by 0·09 mm.

Localities, etc.:—P.F. 10,881. Umhloti river mouth (Natal), N. by W. $\frac{1}{2}$ W. $8\frac{1}{2}$ miles. By large dredge. Depth, 40 fathoms. Bottom, sand and shells. Date, Dec. 18, 1900.

P.F. 10,948A. Tongaati river mouth, N.W. by N. $\frac{1}{4}$ N. $5\frac{1}{2}$ miles. By large dredge. Depth, 36 fathoms. Bottom, sand and shells. Date, Dec. 20, 1900.

This species appears, in the main, to agree with the characters of *Metalcyonium clavatum* given by PFEFFER, MAY, and KÜKENTHAL; unfortunately, there are no figures of this species, and only scanty ones of its spicules. There are certain differences, but such as might probably occur in members of the same species collected from localities so widely separated as Natal and South Georgia. PFEFFER describes the polyp-bearing part of the colony as sometimes eight times longer than broad, but in my specimen it is only two to three times. His specimens were also larger and of a different colour, namely, slate-grey or nearly white. He speaks of several transversely situated spicules beneath the "zooid" crown. From MAY's description, I gather that the polyp spicules are approximately the same size as in my specimens; but that there are no spicules in the internal cœnenchyma. In my specimens there are a few spicules in the internal cœnenchyma.

KÜKENTHAL's description of his species shows that his specimens were smaller, the upper end of the colony sometimes swollen, and the whole colony slightly bent inwards. The upper end of the colony was not dilated in my specimens. The polyps appear to be larger in his specimens. The number of pinnules is approximately the same. The size of the polyp spicules is also nearly the same. He mentions the absence of horizontally disposed spicules beneath the tentacular series. The spicules agree in the main with those of my specimens. As in my specimens, he found spicules in the internal cœnenchyma, but this does not agree with MAY's observations. KÜKENTHAL's specimens were whitish, the stalk grey. Two or three colonies originated together from

a common base; this I have not observed. I am convinced that this is not a *Bellonella* or *Nidalia*, although its external appearance resembles some members of this genus.

PFEFFER gives the following description of the genus *Metalcyonium*:—"Polypenstock eine Keule von nicht bilateralem Bau. Die basale Anheftung zeigt eine schwache, hautartige Verbreiterung, von der die jungen Stöcke absprossen. Der sterile Stiel im Alter von geringer Längsausdehnung, etwas dünner als der Polypen-tragende Teil. Dieser ist als gestreckte Keule oder Kopf ausgebildet und überall mit einzeln stehenden Kelchen, nämlich hervorragenden (kontrahiert strahligen) Warzen des Coenenchyms, bedeckt, aus denen die Polypenköpfe meist hervorragen. Zooide sind nicht vorhanden; es finden sich freilich überall kleine Polypen; diese sind aber nur jüngere Individuen, denn sie haben einer völlig ausgebildeten Tentakelkranz. Das Coenenchym hat eine derb-hautartige Beschaffenheit. Die Spicula sind geknöpfte Doppelspindeln, die im Stiel spärlicher, in den Kelchen häufiger liegen. Die Polypen-Häuse sind unbewehrt, die Köpfe zeigen perradiale Züge von schlankeren, schwächer bewehrten Spicula. Die neue Gattung gehört nach allen Merkmalen in die Familien der Alcyoniden, wie sie von Verrill eingeführt und von Stüder (*Arch. f. Naturg.* LIII. I. p. 14, und *Challenger Report, Alcyonaria*, p. xviii) wiedergegeben ist. Sie schlieszt sich an *Anthomastus* und *Sarcophyton* an, unterscheidet sich jedoch vor allem durch den Mangel der Zooide."

PFEFFER described two species, *Metalcyonium clavatum* and *M. capitatum*. Three other species have been described, namely, *Metalcyonium patagonicum*, May, *Metalcyonium molle*, Burchardt, and *Alcyonium* (*Metalcyonium*) *novaræ*, Kükenthal.

The distribution of this genus or sub-genus is, so far, as follows:—South Georgia, Patagonia, Japan, Amboina, and the Cape of Good Hope.

Metalcyonium natalensis, n. sp.

Plate I. fig. 2; Pl. III. figs. 15 and 18; Pl. IV. figs. 39 a-c.

This description is based on eight fairly well preserved specimens. Each colony is club-shaped, and consists of a basal trunk and an upper unbranched polyp-bearing portion.

The following dimensions were taken from four specimens:—

| | Specimen A. | Specimen B. | Specimen C. | Specimen D (probably not quite complete at base). |
|--|-------------|-------------|-------------|--|
| Length of entire colony, | 24 mm. | 27 mm. | 38 mm. | 19 mm. |
| Length of trunk, | 14 " | 17 " | 29 " | 12 " |
| Breadth of trunk at middle, | 5 " | 5 " | 4 " | 4 " |
| Length of polyp-bearing part, | 10 " | 10 " | 9 " | 7 " |
| Breadth of polyp-bearing part at middle, | 9 " | 9 " | 7 " | 6 " |

The colonies are of a light chocolate colour, the lighter shade being produced by the presence of numerous colourless spicules. These spicules are conspicuously present on the surface of both the trunk and the polyp-bearing part, but more especially on the latter. The surface of the trunk is marked by longitudinal and transverse lines and grooves. In the better expanded specimens, the trunk is seen gradually to taper towards the base. In some cases, organic objects such as corals are seen at the base of the colony.

The extremely large number of slightly projecting spicules is noteworthy, and these are so abundant as to give to the surface of the colony a certain degree of roughness. For example, when a needle is drawn along the surface, a sound is produced similar to that which would be heard on scraping a rough pebble.

The polyps appear to have no definite arrangement, but are irregularly scattered over the surface. They are completely retractile within the cœnenchyma, and in this state must be efficiently protected by the numerous spicules which surround the openings. In my specimens the polyps are, as a rule, not well expanded, but a crown with tentacles, a stomodæal part, and a slightly developed eight-partite calyx is recognisable. One of the better expanded polyps measured 2 mm. in length by 1 mm. in breadth. The appearance of a partially retracted polyp is that of a slightly raised area on the surface of the cœnenchyma. This area is covered over, except at the centre where the tentacles appear, by eight triangular parts with spicules and constituting the calyx.

Transverse sections through the trunk show large canals internally, and smaller canals externally. Numerous spicules are present in the rind. The spicules are here shorter than in the external cœnenchyma of the upper part of the colony; there are comparatively few in the centre of the trunk.

Pl. III. fig. 18 represents a transverse section through the apical part of the cœnenchyma, after removal of the spicules. It shows externally numerous small cavities in which the spicules were embedded, and more internally the polyps with intervening capillary tubes (see footnote, p. 561).

There is much uniformity in the shape of the spicules from different parts of the colony. They are usually clubs, a few spindles also occurring. The absence of spicules from the polyp (excepting calyx) is noteworthy.

In the fully retracted condition, the calyx appears simply as a flat, eight-rayed star. The diameter of partially retracted polyps varies from about 0.50 to 2.80 mm.

Transverse sections through the polyps show that the stomodæal wall is very thick, the siphonoglyphe is ciliated, and the muscles are very feebly developed. The siphonoglyphe appears to be ciliated only for a short distance. There is a strong tendency to a bilateral arrangement; the dorsal and ventral intermesenterial cavities are smaller and more regular than the other six.

The cœnenchyma of the polyp-bearing part has the following structure:—The external part has an immense number of spicules, mostly club-shaped and directed radially; in the central part there are comparatively few spicules. The polyps are

situated in the rind, and extended only a short distance into the coenenchyma. The canals, twelve to twenty in number, occupy the greater part of the central coenenchyma. Numerous connecting capillary tubes are present, and the course of these is as follows:—Capillary tubes pass inwards from the polyps to join other tubes which form an encircling network around the canals of the central coenenchyma; from this encircling network, other still smaller tubes pass into and terminate in the walls of the canals. Pl. III. fig. 15 illustrates this structure better than any verbal description.*

The structure of the coenenchyma, as a whole, resembles in many respects that of *Alcyonium*. The external part of the polyp-bearing region contains more spicules than any other portion of the colony. They are mostly clubs, the heads of which project from the surface; comparatively few spindles occur. The spindles measure from 0.204 by 0.068 to 0.493 by 0.051 mm., and from 0.204 by 0.068 to 0.289 by 0.017 mm. The clubs from the same part measure as follows:—From 0.187 by 0.085 to 0.357 by 0.102 mm., and from 0.212 by 0.051 to 0.323 by 0.102 mm. The spicules are also abundant in the rind of the trunk, and are chiefly clubs. They have the following dimensions:—From 0.102 by 0.142 to 0.238 by 0.068 mm. The centre of the trunk has comparatively few spicules: these are mostly clubs. Their dimensions range from 0.17 by 0.068 to 0.204 by 0.068 mm.

Plate III. fig. 15 shows the presence of a number of gonads or possibly embryos in the canals of the coenenchyma. Unfortunately, I have not a sufficient number of this interesting new species to enable me to make a detailed study of these gonads or embryos.

Locality, etc.:—P.F. 10,993. Off Umhloti river mouth (Natal). Depth, 39 to 40 fathoms. By large dredge. Sand and shells (hard ground). Date, Dec. 21, 1900.

This form differs from *Metalcyonium clavatum*, Pfeffer, by a sharper differentiation into polyp-bearing and stalk portions, by the absence of spicules in all parts of the polyp with the exception of the calyx, and by the spicules in the rind of the trunk being clubs, not slender rods.

It also differs from *Metalcyonium capitatum*, Pfeffer, which has a distinctly flattened form, and polyps present on the basal part of the colony. *Metalcyonium capitatum* has also spicules in the pinnules and a crown of eight rows in the polyp head. The spicules of the rind are straight rods, not clubs, and the colour of the colony is light orange.

My species is readily distinguished from *Metalcyonium patagonicum*, May, by its form and by the absence of spicules in the upper part of the polyp.

Metalcyonium molle, Burchardt, is a form apparently without spicules, but it has not been well described. My species may come nearest *Metalcyonium novaræ*, Kükenthal (from the Cape of Good Hope), but the latter shows the following differences:—

* While this paper was passing through the press, I have learned that in *Alcyonium digitatum* "the fine lines which look like capillary tubes really consist of strings or rows of cells" and "have no lumen." The structures described above are probably similar.

(1) The stalk part is not very distinct, as the polyps sometimes originate far down on the colony; (2) there are spicules in the axes of the tentacles; and (3) numerous pinnales occur on the inner surface of the latter, a feature which also appears in the genus *Sinularia*.

Metalcyonium patagonicum, May.

? *Alcyonium antarcticum*, Hickson.

Plate I. fig. 8; Pl. II. fig. 12; Pl. III. figs. 22, 26-29; Pl. IV. figs. 30-32.

This description is based on a number of specimens from different localities. It must be regarded as a species which is fairly common in South African seas. The specimens show a very obvious external resemblance in form and even in colouring to young mushrooms, especially to the so-called Fly-mushroom, *Amanita muscaria*, and to the bulbous mushroom, *Amanita bulbosa*.

The colony shows three main parts:—Firstly, a globular head (pileus) bearing numerous polyps; secondly, a barren stalk or trunk which may be termed the “stipe”; and thirdly, at the base of the latter, a horizontally expanded part, which encrusts various objects, organic and inorganic. In several of my specimens, this last part is not present, having been torn away in dredging.

The dimensions of three of the larger specimens were as follows:—

| | Specimen A (with yellow tentacles). | Specimen B (with red ten- tacles). | Specimen C (with red ten- tacles). |
|---|---|--|--|
| Length of colony, | 25·6 mm. | 29·8 mm. | 37·0 mm. |
| Length of globular head (pileus), | 13·6 ” | 12·0 ” | 13·0 ” |
| Diameter of globular head (pileus), | 16·0 ” | 18·0 ” | 17·0 ” |
| Length of trunk (stipe), | 12·0 ” | 17·8 ” | 24·0 ” |
| Diameter of trunk (stipe), | 11·0 ” | 10·5 ” | 13·0 ” |
| Diameter of fairly expanded polyp taken at calyx, . | 3·0 ” | 2·0 ” | 2·0 ” |
| Diameter of contracted polyp taken at calyx, . | 1·0 ” | 1·0 ” | 1·0 ” |

The colours of specimens vary considerably, and are in all cases produced by the spicules; the following four variations of colour may be noted:—

| | Specimen A. | Specimen B. | Specimen C. | Specimen D. |
|---|---------------------|--------------------|---------------------|---------------------|
| Ground colour of head (pileus), | Yellow. | Red. | Yellow or white. | Yellow or white. |
| Tentacles, | ” | Red and orange. | Red. | Yellow. |
| Calyx, | ” | Orange. | ” | Red. |
| Internal wall of stomodæum, | White or yellow. | Red. | ” | ” |
| Internal cœnenchyma of head (pileus), | Red or white. | Mostly red. | | |
| External trunk (upper part of), | White. | Red. | Brownish. | Brownish. |
| External trunk (lower part of), | Red. | ” | Red. | Red. |
| Internal trunk, | Red and white. | Mostly red. | | |

It appears, however, that between these different types or varieties of coloration, there are intermediate stages grading the one into the other.

The polyps show themselves on the surface of the "pileus" in varied degrees of expansion and contraction. A number of young polyps are present between the better developed ones. The polyps are capable of being withdrawn within the eight-partite calyx. On retraction, the tentacles are drawn down, but are not inverted. The number of pinnules in the tentacles was not observed.

It was fairly easy to remove well-expanded polyps out of their canals, and as they are fairly transparent, their structure is readily understood. The polyp is differentiated externally into three parts:—

1st, A crown and tentacles with long spindles arranged *en chevron* in eight more or less triangular stripes. These eight longitudinal stripes unite more or less at their bases into a ring of spicules, which encircles the upper part of the polyp. This circular band is not well developed, consisting only of a few spicules horizontally or obliquely disposed.

2nd, A stomodæal part, with small spicules in the wall of the stomodæum (proper).

3rd, A part containing the mesenterial filaments, and devoid of spicules.

The calyx projects on the surface of the coenenchyma as a ring containing small red spicules. The calyx has an outer and inner wall, both containing spicules, but the outer wall has a larger number. The outer and inner walls of the calyx are transversely connected with one another at intervals by small tubes. The calyx is retractile.

The colours of the polyps are produced by the spicules; those of the tentacles are yellow or red, or yellow and orange apically, and red ones at the base. The spicules of the stomodæum (proper) are also yellow or red, and those of the calyx are yellow, red, or orange.

The muscles in the stomodæal part of the polyp are extremely large; in some cases they fill up at least half the space of the intermesenterial cavities. The siphonoglyphe is broad and ciliated, and directed, in all observed cases, towards the exterior or away from the centre of colony. The ectodermal wall of the stomodæum is thick, the mesogloea extremely thick, and the endoderm thin. The cavities of the polyps are continued directly downwards into the canals running down through the trunk. In the globular head, there exists a distinct coenenchyma between the polyp cavities; but in the trunk region this is not so, as the walls between the canals are very thin.

A rough transverse section through the "pileus" shows an extremely large number of spicules, especially in the outer part. These spicules are long, spinous spindles or needles. One of these measured as much as 0.816 mm. in length. The long spindles are, as a rule, disposed radially; besides these, there are also a few short spicules. A rough section through the trunk shows again a very large number of spicules, but they

are here of a different form, namely, short double clubs, etc. These spicules are again more numerous in the rind than towards the centre.

The spicules of the tentacles and of the crown of the polyp are long spindles, straight or curved; in some cases, these spindles are all red, in others yellow, or both yellow and red may occur in the same specimen, the yellow being situated apically. These spindles measure from 0.333 by 0.034 to 0.408 by 0.017 mm. At the tips of the tentacles, the spindles are shorter than at the base and are, at least in some cases, replaced by double spindles. The spicules of the stomodæum (proper) are small rods or spindles, red or yellow. They measure from 0.102 by 0.051 to 0.0391 by 0.0306 mm.

The spicules of the calyx have the form of small double, red, yellow, or orange clubs and rods. They measure from 0.051 by 0.017 to 0.0765 by 0.034 mm.

The upper coenenchyma between the polyps shows two varieties of spicules: firstly, long spindles, and secondly, short double clubs and rods. The long spindles measure from 0.1054 by 0.0391 to 0.4165 by 0.034 mm.; exceptionally, longer spindles may occur, such as that noted previously.

The short, double clubs do not show much variation in size, measuring from 0.051 by 0.0204 to 0.0765 by 0.034 mm.

The spicules of the external trunk are mostly double clubs, double spheres or wheels. There are also a few long spindles or rods. The double spindles measure from 0.0595 by 0.034 to 0.187 by 0.0765 mm. The long spindles measure from 0.1955 by 0.034 to 0.629 by 0.051 mm. The spicules of the internal trunk are of various kinds, namely, double clubs, long clubs, short spindles, and long, slender, needle-like spindles and spicules of irregular form. The double clubs measure from 0.0816 by 0.051 to 0.119 by 0.0765 mm.

The irregular spicules have approximately the same dimensions. The long needle-like spindles measure from 0.187 by 0.034 to 0.816 by 0.051 mm.

Localities, etc.:—P.F. 13,459, 13,459B, and 13,460. Sandy Point, N.E. by N. $6\frac{1}{2}$ miles. By dredge. Depth, 51 fathoms. Nature of bottom, broken shells and stones. Date, August 14, 1901.

P.F. 13,174. Cape Morgan, N. $\frac{1}{2}$ W. $10\frac{1}{2}$ miles. By dredge. Depth, 77 fathoms. Bottom, rocks and broken shells. Date, July 26, 1901.

P.F. 11,351. Tugela river mouth, N.W. by N. $\frac{1}{4}$ N. 25 miles. By large dredge. Depth, 65–80 fathoms. Bottom, hard ground. Date, January 11, 1901.

P.F. 11,587. Amatikulu river mouth, N.W. $\frac{3}{4}$ N. 20 miles. By large dredge. Depth, 62 fathoms. Bottom, rocks and sponges (hard ground). Date, January 30, 1901.

I place this species as *Metalcyonium patagonicum*, May, and as being identical with the form described by HICKSON from Cape waters as *Alcyonium antarcticum*, W. and S.

KÜKENTHAL regards the two last mentioned as probably identical. It appears to



me also that the species from the Cape named *Alcyonium antarcticum* by HICKSON is not rightly so designated. The description and figures given by HICKSON do not sufficiently agree with the description and figures given in the *Challenger* Report, and Professor STUDER also regards HICKSON's *Alcyonium antarcticum* as a mistake. More recently I have had the opportunity of examining Hickson's type specimens. At first I thought that the species under consideration was probably *Metalcyonium capitatum*, Pfeffer. PFEFFER says: "Der Polypenstock hat das Aussehen eines jungen Pilzes, d.h. er ist kurz gestielt mit dickem Kopfe, oder der Stiel ist ganz verschwunden und der ganze Stock stellt ein kopfartiges Gebilde dar."

This resemblance between the two species appears to be mostly a superficial one, for *Metalcyonium capitatum* shows the following features which separate it from my form:—

(1) It appears to be frequently flattened in form; (2) the polyp-bearing part is not sharply separated from the so-called sterile part; (3) the calyx is not very clearly defined; (4) a transverse ring of spicules below the tentacles does not occur; (5) the stomodæal tube has no spicules; (6) the polyps appear to stand much nearer one another.

Metalcyonium clavatum, Pfeffer, has the following characters distinguishing it from my species:—

(1) It has no sharp distinction into trunk and head; (2) the polyps are not sharply differentiated into retractile part and calyx; (3) the stomodæum is free from spicules; (4) several colonies frequently appear to originate from a common base.

Metalcyonium patagonicum has been described by MAY and KÜKENTHAL. The specimens are described as club-shaped. The spicules of the polyps appear to agree in the main with those of my specimens. My specimens are considerably larger. In both, there is a gradual passage from the membranous base into the trunk. The polyps in my specimens do not stand closer to one another above than below. The spicules of the tentacles in my specimens are much larger. There is no mention of spicules being present in the stomodæal canal of May's specimens.

We thus see that there are a number of differences; but some of these are probably more apparent than real, due on the one hand to incomplete description, on the other to variation, for this is one of those species which seem to vary very considerably.

In regard to the specimens described by HICKSON from South Africa under the name *Alcyonium antarcticum*, we may note that his colonies were procured from ground of a different nature. He gives a figure of a specimen which rather differs from my larger examples, but resembles some of the younger forms in my collection. As KÜKENTHAL suggests, Hickson's specimens were probably young forms. The relative size of the polyps in Hickson's specimens appears to be greater than in my forms.

KÜKENTHAL has divided the genus *Alcyonium* into three sub-genera, namely: (1) *Alcyonium*, s. str., (2) *Metalcyonium*, Pfeffer, (3) *Erythropodium*, Kölliker. Whether this classification is a good one or not, will be seen after further systematic work has been done on this genus.

Alcyonium purpureum, Hickson.

Plate III, fig. 16 ; Pl. IV, figs. 24 and 25.

This description is based on several large colonies. The largest specimen was roughly hemispherical in shape, and measured 68 mm. in length, 55 mm. in breadth, and about 27 mm. in height.

The base of the colony was attached to a Tethya-like sponge. The colony consisted of a number of lobes, over 40 in the large specimen, each lobe measuring from 10 mm. in height and 6 mm. in diameter to 19 mm. in height and 7 mm. in diameter. The lobes of the colonies have no stalks or trunks, but are connected with one another by a flat encrusting cœnenchyma provided with many spicules on its upper and a few spicules on its lower surface, and containing internal canals which pass into connection with those in the interior of the lobes. The colour of the colony in the living condition is brilliant purple, the tentacles being brown.

The polyps show a tendency to a spiral arrangement on the surface of the cœnenchyma. The number of polyps in the larger lobes is 30 to 40. They are completely retractile within the cœnenchyma, and are thus protected by a dense framework of spicules. None of the polyps in my specimens were completely expanded, but those fairly well extended measure from 3·8 mm. in height and 1 mm. in diameter to 4 mm. in height and 2 mm. in diameter. The retracted polyps measure from 1·1 mm. in height and 1·0 mm. in diameter down to minute fractions of a millimetre. The polyps are differentiated externally into two parts, a crown and a stomodæal part.

On the crown, the spicules are arranged in eight triangular areas, pointed above. They appear to be arranged *en chevron*, but more irregularly than in the typical *en chevron* arrangement. The spicules of this part are mostly spindles. The spicules protrude on the surface of the polyp, but this is more especially the case on the stomodæal part, where this feature is very apparent. On the stomodæal part, the spicules are arranged in eight parallel bands, whose bases pass gradually into the general surface lying between the different polyps. There appears thus to be a gradual transition from the base of the polyp into the rind of the cœnenchyma, and no differentiation into a calyx. The spicules of the polyp are numerous, and protrude so much on the surface as to produce roughness to the touch. With a low power, the external surface of the stomodæal part appears as if studded with small rough tubercles which are the protruding heads of clubs, spheres, and double spheres. In spirit, the spicules are of a coral-white colour.

Transverse sections through the polyp show that the muscles are well developed, the siphonoglyphe is ciliated, the mesenterial filaments are well developed, and the dorsal and ventral intermesenterial cavities are slightly smaller than the other six. The ciliated groove is directed towards the external cœnenchyma or rind. The cœnenchyma contains about a dozen canals. The rind of the cœnenchyma contains a

very large number of spicules, the central part also a considerable number, but not so many. The more internal canals are slightly larger than those of the exterior.

The spicules on the crown at the bases of the tentacles are mainly spindles with short spinous processes. In the stomodæal part of the polyp there are spheres, double spheres, and clubs. The last are the most numerous and prominent. All these spicules are provided with thick, blunt processes (protuberant tubercles). Spicules are absent in the wall of the stomodæal tube. The spicules of the external cœnenchyma are spheres, double spheres, spindles, and clubs. These are, as a rule, provided with protuberant tubercles. The spicules of the internal cœnenchyma are spheres, double spheres and double clubs, all with protuberant tubercles. The spicules of the basal connecting part, namely, that part connecting different polyp lobes together, are double clubs. It may be noted that spindles are characteristically present in the polyps and in

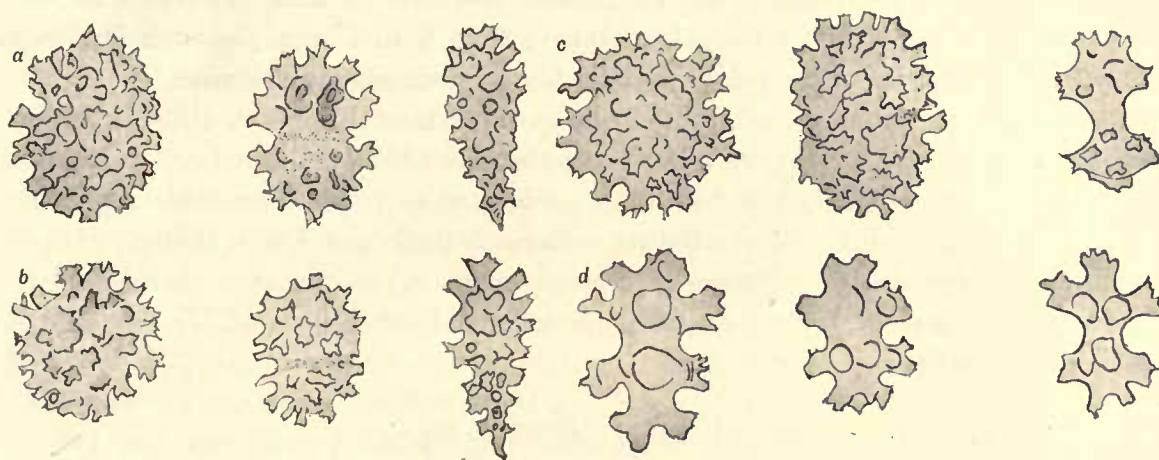


FIG. 1.

the external cœnenchyma, but are not found in the internal cœnenchyma and basal connecting part.

The adjoining figure shows the spicules of *Alcyonium purpureum*:—(a) spicules of the polyp; (b) spicules of the external cœnenchyma; (c) spicules of the internal cœnenchyma; and (d) spicules of the basal connecting part of the colony. $\times 150$.

The following measurements of the spicules may be noted:—

a. From the polyps:—(a) Spindles, from 0·1054 by 0·0340 to 0·246 by 0·0340 mm.; (b) clubs, from 0·136 by 0·102 to 0·2754 by 0·102 mm., and from 0·153 by 0·0595 to 0·2754 by 0·102 mm.; (c) spheres and double spheres, from 0·136 by 0·119 to 0·170 by 0·119 mm., and from 0·136 by 0·119 to 0·1615 by 0·1275 mm.

b. From external cœnenchyma:—(a) Spindles, from 0·085 by 0·0425 to 0·2635 by 0·085 mm.; (b) spheres, from 0·119 by 0·0935 to 0·153 by 0·136 mm.; (c) double spheres, on an average, 0·170 by 0·102 mm.; (d) clubs, on an average, 0·1445 by 0·068 mm.; (e) double clubs, from 0·085 by 0·068 to 0·136 by 0·085 mm.

c. From internal cœnenchyma:—(a) Spheres and double spheres, from 0·1275 by

0·085 to 0·306 by 0·170 mm.; (b) double clubs, from 0·102 by 0·068 to 0·153 by 0·102 mm.

d. From basal part connecting the polyp lobes:—Double clubs, from 0·085 by 0·085 to 0·1275 by 0·935 mm.

The large specimen showed a very large number of gonads, or possibly embryos (Plate III. fig. 16); these were sometimes so abundant as to fill up the canals to a great extent. I reserve these for future study.

HICKSON has already described this species from Mossel Bay, Cape Colony. This form is specially noteworthy on the shore at Kalk Bay and other places, on account of its brilliant purple colour. This pigment disappears very readily during the process of preservation, although numerous endeavours were made to retain it.

Hickson's largest specimen was smaller than the specimen here described. The number of lobes in his specimen was 15, in mine there are as many as 40. The lobes in his example had a larger diameter, namely, from 8 to 15 mm., in mine from 6 to 7 mm. The diameter of the polyps appears to be approximately the same.

In connection with my description of this species, I take the opportunity of mentioning my indebtedness to Professor HICKSON, who most kindly allowed me to examine the specimens described by him from the Cape as well as preparations of the spicules.

Locality, etc.:—P.F. 739. Between Roman Rock and Cape Recife. Depth, 17 fathoms. By dredge. Nature of bottom, coral. This species is also frequently found on the shore at Kalk Bay, Gordon's Bay, and other places. It is distinctly a shallow-water form.

Alcyonium fauri, n. sp.

Plate I. fig. 5; Pl. IV. fig. 44.

This description is based on a single specimen. The colony is encrusting, and consists of a fairly hard, compact mass of closely adjacent lobes bearing the polyps. Each lobe is more or less hemispherical in shape, and the polyps borne on the circumference are continued internally into the soft coenenchyma. The lobes have no stalks, but all arise from a common, horizontal, encrusting lamella. This basal, horizontal expansion projects externally at some places, to a slight extent, beyond the basal edge of the polyp lobes. It is provided with numerous spicules, and contains horizontally directed canals. Its thickness is from 1 to 2 mm. The number of lobes in the colony is about 20, but in the case of the small lobes, the line of separation is not very distinct. The colony measures 41 mm. in length, 32 mm. in breadth, and 9·5 mm. in height. The colour of the colony is light brown.

The number of polyps in the lobes varies considerably; one of the smaller lobes shows about 20, and one of the larger from 50 to 60. A large lobe measures 11 mm. long, 11 mm. broad, and 9 mm. high. The polyps appear to have no definite arrangement, but they are more numerous and better expanded at the margins than in the centre of the lobes.

The polyps show varied degrees of expansion and contraction, the best expanded showing tentacles and pinnules, the most contracted being withdrawn and covered over by the cœnenchyma. On retraction, the tentacles are apparently drawn downwards, but the pinnules are not inverted. A well-expanded polyp extends about 3 mm. above the surface of the cœnenchyma, and has a diameter of about 1 mm. The diameter of a fairly contracted polyp extends about 0.35 mm. on the surface of the cœnenchyma. The calyx is not well defined. The well-expanded polyps at the margins of the lobes lie closely adjacent to one another; in the centre of the lobes, however, contracted polyps may be separated by an interval of 1 mm. Some of the better expanded polyps show eight faint, longitudinal lines on the surface. Each tentacle bears at least 9 pairs of pinnules. The polyps themselves have apparently no spicules, though these are aggregated in large numbers at their bases. A fairly contracted polyp has the appearance of a swelling with eight lines on its surface, or is merely a papilla without any such differentiation.

The following points in the internal anatomy may be noted:—The muscles are large, and the invaginated ectodermal wall of the stomodæum is thick. In the uppermost part of the polyp, the siphonoglyphe is not well defined, but further down it is wide and possesses numerous cilia. In several polyps, the siphonoglyphe is seen to be situated towards the outside, or, in other words, away from the centre of the cœnenchyma. The endodermal layer in the stomodæal part of the polyp is extremely well developed. The mesenterial filaments, when well developed, appear to be grouped in 4 or 5 lobes on each mesentery. The cavity of each polyp is continued into a canal, which passes down through the cœnenchyma to near the base of the colony. At the very base, these more or less vertical canals communicate with one another, and expand into others which run horizontally in the lamella-like, encrusting part.

An interesting feature was the occurrence of female gonads and eggs in the canals of the cœnenchyma, and also more rarely in the part of the exposed polyp containing the mesenterial filaments. The eggs showed nucleus and nucleolus very clearly. As I have only one specimen of this species I am unable to follow up the study of these gonads and eggs.

The spicules are found in the flat, encrusting, basal part of the colony, and in the cœnenchyma at the base of the polyp. I had hesitation in deciding whether the latter spicules belonged properly to the polyps or to the cœnenchyma, but sections lead me to think that the spicules of the external cœnenchyma are simply more abundant at the base of the polyps. There are no spicules in the internal cœnenchyma. The spicules of the encrusting base do not vary to any extent, either in size or shape, from those of the polyp-bearing part. They are in both cases double wheels, and have the following dimensions:—From 0.0999 by 0.0729 to 0.1215 by 0.0837 mm., and from 0.1026 by 0.0675 to 0.1215 by 0.0945 mm. The rind of the lobes is hard and compact, but this is due not so much to the spicules as to a fibrous condition.

This form shows a number of points of resemblance with *Alcyonium globuliferum*,

Klunzinger, as described by him from the Red Sea. In both, the colony is encrusting, and KLUNZINGER describes the colony of *Alcyonium globuliferum* as brain-like in appearance, a term which might with some slight stretch of imagination be also applied to this species, especially if all the polyps had been in the retracted condition. In both, the lobes composing the colony are pressed close together and flattened on their adjacent sides, their shape above is flat-spherical; the lobelets are separated by narrow grooves, and the colour of the polyps is brown. I place my form as a distinct species on account of the following differences:—In *Alcyonium globuliferum*, the lobes bearing the polyps stand on stalks .5–1 cm. in height; in *Alcyonium fauri*, there are no stalks. In *Alcyonium globuliferum*, the polyp lobes are larger, the greatest being 2–3 cm. broad; in *A. fauri*, only 1.1 cm. broad. The spicules of the two species differ in shape. The colour of *Alcyonium globuliferum* is very white, of *A. fauri* brown, but one cannot take the latter as an important specific character. *A. fauri* resembles *A. purpureum*, Hickson, in the absence of a stalk to the polyp lobes, but differs from it in *habitus*, in the absence of a soluble pigment, in having shorter polyp lobes, in the absence of spicules arranged in triangular shields on the upper part of the polyp, and in other features.

I have named this species after the Government steam trawler at the Cape, the *Pieter Faure*, on which these specimens were collected. This steamer received its name from the Minister of Agriculture, Sir Pieter Faure, who took much interest in the development of fishery and marine biological investigations in South Africa.

Locality, etc.:—"Pieter Faure," No. 10,130. Cape St Blaize, N.N.W. 8 miles. Depth, 36 fathoms. By large trawl. Nature of bottom, mud and sand with black specks. Date, August 27, 1900.

Alcyonium pachyclados, Kl.

Plate II. fig. 14; Pl. IV. figs. 33 and 34.

It may be doubted whether this form should not be placed under the genus *Lobularia*, Savigny, but as HICKSON has recently recorded this identical species from Cape waters as *Alcyonium pachyclados*, I hesitate to introduce a change. The genus *Lobularia* was founded by SAVIGNY and LAMARCK in 1816. In 1857 MILNE-EDWARDS published a revision, and referred *Lobularia* to the genus *Alcyonium*. KLÜNZINGER (1877) described a number of species, including the one here under discussion, and placed them under the genus *Alcyonium*. WRIGHT and STUDER (1889) separated *Alcyonium* from *Lobularia*, regarding the latter as a tropical genus. Professor STUDER has shown me a form from Zanzibar which he regards as a typical *Lobularia*, and my specimen appears to be more allied to it than to the genus *Alcyonium*. WRIGHT and STUDER wrote as follows:—" *Lobularia* can hardly be separated from *Alcyonium*, and KLÜNZINGER has included it in the same genus. Yet one may with EHRENBURG distinguish as *Lobularia* forms, those Alcyonids in which the short broad stem is furnished with a number of lobes and lappets and in which the coenenchyma is very

thickly beset with short calcareous spicules, especially double-clubs, ordinary clubs and spindles, so that it acquires a thick leathery consistence."

In the Museum of Natural History, Berne, EHRENBURG's type specimen of *Lobularia pachyclados* is preserved, and I have been able to compare it with the specimen here described.

My specimen agrees well with the description and figures of *Alcyonium pachyclados*, Klunzinger, but in his account there is no information regarding the anatomy. As my specimens were sufficiently expanded to enable me to count the number of pinnules, this and other points may prove of systematic value.

HICKSON had a red, a yellow, and a white specimen from the Cape. The red specimen was a female, the yellow specimen a male, and the white specimen apparently in a neutral condition. In my case, the specimens show the reverse, the female being yellow and the male red; thus the colour is obviously not to be regarded as a sexual character.

THOMSON and M'QUEEN (1908) record *Alcyonium sphærophorum* (Ehrenberg) from the Sudanese Red Sea, a species originally described from that locality by KLUNZINGER. The authors suggest the incorporation of *A. pachyclados* and *A. sphærophorum* as one species. They are also inclined to think that *A. globuliferum*, Klunzinger, *A. digitulatum*, Kl., *A. brachyclados*, Ehrenberg, and *A. pachyclados*, Kl., should all be referred to one species, viz. *A. sphærophorum*.

MAY has recorded *A. pachyclados* from Albay (Luzon) and from Zanzibar. PRATT has personally examined and compared forms of *Alcyonium pachyclados* from the Cape with specimens of the same species from the Maldives and New Britain, which are found to be identical with *Alcyonium pachyclados*, Kl., from the Red Sea. The author finds that the forms of this species from the Cape, Maldives, and New Britain agree with one another in all important features, only differing in form and colour. PRATT therefore holds that here we have identical forms collected from tropical waters and a temperate? region (the Cape), and that therefore one can no longer regard *Alcyonium* as an extra-tropical genus. From this fact and the somewhat vague diagnosis of *Lobularia*, PRATT maintains that this genus should be deleted from the family Alcyonidæ. The point on which I mainly disagree with PRATT's argument is that of regarding South African seas as necessarily temperate. As a consideration of isothermic lines will show, the water temperature on the east coast of South Africa is at the least only on the border between tropical and temperate.

The forms of *A. pachyclados* compared by PRATT were found in the Red Sea, in tropical seas, or in a region influenced by tropical currents. A warm tropical current flows from the Indian Ocean down the east coast of Africa (where these forms of *A. pachyclados* occur). This warm current, known respectively as the Mozambique, Natal, and Agulhas currents, influences the nature of the fauna on the east coast of South Africa. GILCHRIST has pointed out examples showing the difference between the fauna on the warm east coast, as compared with that on the west coast, where the fauna is influenced by the cold Benguela current.

My description is based on several yellow specimens and one red example from different localities. The colony is composed of a massive primary or central trunk which gives off secondary branches, and these in their turn may have tertiary or terminal branches. The following measurements may be noted:—

| | Yellow Specimen. | Red Specimen. |
|--|------------------|---------------|
| Height of colony, | 34·0 mm. | 54·0 mm. |
| Diameter of colony, | 33·0 " | 69·0 " |
| Length of primary or central trunk, | 14·5 " | 9·0 " |
| Diameter of central trunk, | 16·0 " | 34·0 " |
| | | About |
| Length of polyp-bearing part of colony, | 19·5 " | 24·0 " |
| Length of secondary branches, | 5·0 " | 16·0 " |
| Diameter of secondary branches, | 8·0 " | 10·0 " |
| Length of terminal branch, | 4·5 " | 5·0 " |
| Diameter of terminal branch, | 4·0 " | 4·0 " |
| Length of polyp with tentacles and pinnules, | 0·85 " | (None of the |
| Diameter of spread of tentacles, | 1·105 " | polyps were |
| Diameter at base of polyp, | 0·425 " | extended) |

The polyps are irregularly scattered on the entire surface of the colony, except on the basal part of the trunk. The polyps are completely retractile, and in this condition are covered over by the general surface of the coenenchyma, which is very abundantly provided with small spicules. The rind cannot, however, be described as hard. There is apparently no calyx.

In my specimens the polyps were, as a rule, withdrawn, but when not so were seen to be small, colourless, and entirely devoid of spicules. In regard to the system of canals in the coenenchyma, it is that of a typical Alcyonium arrangement. The coelentera are continued as canal-like tubes down the trunk. In regard to the structure of the polyps, the siphonoglyphe is ciliated and directed towards the exterior or away from the centre of the colony. Neither the muscles nor the mesenterial filaments are well developed. The polyps are almost entirely white, and are devoid of spicules. The number of pinnules in a tentacle is eighteen.

The spicules of the colony are mostly double spheres; there are also a few much smaller and more irregular spicules which are more or less oblong, but with a narrowed median part and with four or more spines at the margin. The spicules are distributed in the external coenenchyma of the polyp-bearing part, and in the rind of the trunk, but there are either none or very few spicules in the centre part of the colony. The double spheres of the yellow specimens measure from 0·0256 by 0·0189 to 0·0513 by 0·0351 mm. The double spheres of the red specimen measure from 0·0486 by 0·0378 to 0·0594 by 0·04455 mm. The small, more irregular spicules measure approximately 0·0270 by 0·0189 mm. The red specimen contains a few yellow spicules, although the majority are naturally red.

In sections of the yellow-coloured specimen, the occurrence of female gonads and eggs in the canals of the coenenchyma was readily observed. The eggs were apparently mature, and their structure was very clear, the nucleus and nucleolus being very distinct. Sections of the red specimen showed the presence of numerous male gonads. The male gonads showed a central mass consisting of sperms surrounded by a thin, structureless, membranous wall, and this latter by an epithelial layer of cells.

Localities, etc.:—P.F. 12,979. Yellow variety. Gonubie River, N.W. by W. $\frac{3}{4}$ W. 3 miles. By dredge. Depth, 20 fathoms. Nature of bottom, broken shells. Date, July 11, 1901.

P.F. 1085. Red variety. Algoa Bay, between Roman Rock and Cape Recife. By dredge. Lat. $34^{\circ} 0' 45''$ S.; long. $25^{\circ} 43' 45''$ E. March 7, 1899.

Specimens of both varieties were obtained from a number of other localities, and this species must be regarded as common in South African seas.

Alcyonium rotiferum, n. sp.

Plate I. figs. 3 and 4; Pl. IV. fig. 38.

This description is based on one complete and two incomplete colonies. The specimens were well preserved, and the polyps were expanded. The colony consists of a number (in my specimen about 12) of slender cylindrical lobes, the stalks of which unite slightly together at their bases. These lobes sometimes pass into smaller lobes or lobelets. The bases of the stalks are slightly turned inwards so as to form a supporting basis for the colony. The length of the stalk parts is comparatively short, namely, $\frac{1}{5}$ to $\frac{1}{6}$ the length of the polyp-bearing branches. The rind of the colony is tough and leathery, and has numerous spicules—more so than the centre. The surface of the stalk and polyp-bearing part is marked by characteristic folds which divide it up into a number of distinct areas, and give it a somewhat crumpled appearance.

The surface of the stalks and of the polyp-bearing parts is of a yellow colour produced by numerous spicules. These spicules, when cleaned and isolated, appear to the naked eye like minute grains of gold. The polyps are seen on the yellow ground-mass as beautiful, white, flower-like structures. They are present in various states of expansion and retraction, and have an arrangement approaching a spiral. At the apices of the lobes, one large polyp is generally seen surrounded by four smaller ones. The following measurements were taken:—

| | |
|---|--------------|
| Maximum length of colony, | 43.0 mm. |
| Maximum breadth of colony, | 30.5 „ |
| Length of longest lobe of colony, | 39.0 „ |
| Length of part of above, which bears polyps, | 30.0 „ |
| Greatest diameter of lobe, | 7.5 „ |
| Length of common basal part of colony (trunks more or less united), | 6.5 to 9.5 „ |
| Breadth of last at base, | 10.5 „ |

The polyps are enveloped at their bases by yellow calyces with numerous spicules. These calyces are eight-partite above, but apparently the parts may become partially subdivided lower down. The polyps are completely retractile within the calyx. There is remarkably little connection between the polyp proper and the calyx, and thus it is a simple matter to slit open the calyx and remove the polyp. The polyp proper has no spicules. The tentacles have about eight pairs of long narrow pinnules. The length of the polyp after removal from the calyx is 3·0 mm., its greatest diameter 2·0 mm., the diameter of spread of extended tentacles about 2·0 mm., the height of the calyx about 1·9 mm., the diameter of the calyx about 2·0 mm. The polyps are separated from one another by a distance of about 2 mm.

Transverse sections show that the stomodæal wall is fairly thick, the siphonoglyphe is ciliated, and the muscles and mesenterial filaments are pretty well developed. Transverse sections through the apical part of the coenenchyma show that the young polyps situated in that region have only feebly developed muscles. It is also seen that the ciliated groove is directed towards the rind or away from the centre of the coenenchyma.

The coenenchyma of the polyp-bearing part shows the following structure :—

The rind contains numerous yellow spicules, which are double wheels of small size ; in the central coenenchyma there are also double wheels, but these are comparatively few in number. The canals of the external coenenchyma are larger than those of the centre. In some parts, this reduction in the size of the central canals is very well marked, producing greater compactness and some degree of solidity at the centre. It may be that we have here a hint of a transition towards the formation of a central axis.

The stalk portions have a very irregular outline, partly due to the presence of numerous spicules and partly to surface folds. The stalk portions show numerous spicules (double wheels) in the rind, but comparatively few in the centre. The canals of the stalks have a somewhat similar arrangement to that in the polyp-bearing part, but the rind is much thicker ; the canals are smaller, and do not decrease in diameter towards the centre.

The spicules of all parts are double wheels. These double wheels are most abundant in the calyx and more external parts of the colony, but they are also present in smaller numbers towards the centre. Externally, the spicules lie very close to, and almost protrude above, the surface. When a portion of the rind is treated with dilute eau de Javelle and subsequently dried, a small portion of each wheel is seen to protrude above the general surface of the ectoderm. The spicules from all parts may be termed double wheels, but it will be noted from the following measurements that they are not quite circular, the length being greater than the breadth in most cases.

Dimensions :—

- (a) From the rind of the trunk, from 0·0432 by 0·0351 to 0·075 by 0·0621 mm., and from 0·0486 by 0·0324 to 0·0729 by 0·0648 mm.

(b) From the centre of the trunk, from 0·0540 by 0·513 to 0·0621 by 0·0513 mm.

(c) From the calyx, from 0·0378 by 0·0378 to 0·0567 by 0·0405 mm.

(d) From the external and internal coenenchyma of polyp-bearing part, from 0·0324 by 0·0297 to 0·0567 by 0·0459 mm.

Locality, etc. :—P.F. 13,553. Kuskamma Point, N.E. by E. 5 miles. By dredge. Depth, 33 fathoms. Nature of bottom, rocks and broken shells. Date, August 27, 1901.

This species appears to come nearest to *Alcyonium glomeratum*, Hassall, and *Alcyonium flavum*, Quoy and Gaimard, but has clear distinctive characteristics which separate it from both these forms.

MILNE-EDWARDS gives the following diagnosis of *Alcyonium glomeratum* :—

“*Polypiéroïde se divisant très-profondément en un nombre considérable de lobes digitiformes : Polypiéroïde a surface rude.*”

This diagnosis agrees fairly well with my form, but on referring to figures, one sees that the lobes do not originate so near the base as in my species.

A. glomeratum was described from the coasts of Great Britain, and has more recently been recorded by HICKSON from Talili Bay, New Britain. The spicules of *Alcyonium glomeratum* seem entirely different from those of my species. This species appears also to have some points of resemblance with *A. flavum*, Quoy and Gaimard, but one gathers that the latter has a more arborescent and compressed form; that the lobes are pointed, not rounded at the apices, and that the polyps are smaller.

The chief characteristics of the new species are as follows :—

The lobes originate from the base of the colony; the surface of the colony is fairly hard and much wrinkled, and the stalk passes gradually into the polyp-bearing part. The tentacles are petal-like; there are no spicules in the upper part of the polyp; the spicules of the other parts of the colony are small, and have the form of double wheels.

Capnella rugosa, Kükenthal.

1901, *Nephthya rugosa*, Kükenthal.

1903, *Capnella rugosa*, Kükenthal.

Plate II. fig. 10; Pl. IV. figs. 42 a-c.

This description is based on one complete specimen and a small fragment of another.

The colony consists of a trunk, and an upper portion bearing the polyps in lobes or tufts. The colour is, in formalin, light brown, the trunk being of a lighter colour than the polyp-bearing part. The general surface of the trunk is marked by a number of longitudinal lines or grooves, and in its upper part by circumferential wrinkles.

The dimensions of the colony were as follows :—

| | |
|--|----------|
| Length of colony, | 63·0 mm. |
| Length of trunk, | 31·0 „ |
| Diameter of trunk at junction with polyp-bearing part, | 8·0 „ |
| Diameter of trunk at middle, | 11·0 „ |
| Diameter of trunk near base, | 10·0 „ |
| Length of polyp-bearing part (including polyps), | 32·0 „ |
| Diameter of above at middle, | 17·0 „ |
| Diameter of above near apex, | 16·0 „ |
| Diameter of above near base, | 16·8 „ |

The polyps are grouped in tufts or lobes thickly crowded on the upper portion of the colony. In the specimen described, these lobes numbered about fifty. The lobes are sometimes subdivided into several (2–7) smaller lobes or lobelets, but the line of separation is not very distinct. At the base of the polyp-bearing part, the lobes are simple and undivided. The lobes vary from 5·5 mm. in length and 3·0 mm. in diameter to 8·0 mm. in length and 7·8 mm. in diameter. The size of the polyps varies, some measure 2 mm. in length and 1 mm. in diameter.

The arrangement of the polyps on the lobes does not appear to be after any definite plan, but when looked at from the surface, they frequently resemble a miniature blackberry. The surfaces of the polyps are extremely well armed with spicules, in the form of three-rayed and foliaceous clubs, which project all over the surface, and are provided with thorny processes. At the apex of the polyp, the spicules are grouped into eight folds. This is, however, observed only when the mouth of the polyp is looked down upon from above. There are no “Stützbündel.” The tentacles are not retracted in all cases, but on retraction, they appear to be drawn back or down in a manner similar to that described as taking place in *Alcyonium digitatum*. The calyx is apparently absent.

The wall of the stomodæum is thick, and the siphonoglyphe is ciliated, and directed towards the exterior or away from the centre of the colony. The muscles are only slightly developed, and the dorsal and ventral intermesenterial cavities are slightly smaller than the other six, thus producing a tendency towards bilateral symmetry. The mesenterial filaments are well developed.

The canals of the main trunk have fairly thick walls, and the latter show a number of spicules. These canals are wide, and those in the centre are larger than those in the rind. Their number appears to be about fifty, and they are connected with one another by capillary tubes. The continuations of the polyp cavities must evidently unite with one another in their downward course through the trunk.

The spicules are very numerous, and give a hard texture to the entire external surface of the colony. They are more especially abundant on the polyp portion, projecting slightly from the surface, and must form a very efficient source of protection. They also appear to be more plentiful towards the apex of the colony. In the trunk,

they are more numerous in the rind than in the interior. In the central coenenchyma of the polyp lobes, the spicules are fewer in number, but at the same time larger than in the external part. The spicules of the polyp-bearing parts of the colony are three-rayed or foliaceous clubs, one-sided clubs, ordinary clubs, straight and curved spindles. All are beset with broad, thorn-like processes. They measure as follows:—Spindles, from 0.119 by 0.034 to 0.323 by 0.085 mm.; clubs, from 0.136 by 0.102 to 0.340 by 0.119 and 0.2414 by 0.1326 mm.

The spicules from the rind of the trunk are mainly stars and double stars. Their dimensions are as follows:—From 0.102 by 0.102 to 0.187 by 0.1445 mm., and from 0.068 by 0.591 to 0.153 by 0.1275 mm.

The spicules of the internal trunk are stars, double stars, spheres, and spindles. The spheres measure from 0.1360 by 0.119 to 0.221 by 0.153 mm.; the spindles, from 0.1275 by 0.1071 to 0.204 by 0.136 mm.

Locality, etc.:—P.F. 12,993 and 12,994. Gonubie rocks, N.W. by W. $\frac{3}{4}$ W. 3 miles. By dredge. Depth, 20 fathoms. Bottom, broken shells. Date, July 11, 1901.

There can be little doubt that this form is identical with *Capnella rugosa* already described by KÜKENTHAL from South African seas. His specimen was, however, found at a greater depth, namely, 155 metres. KÜKENTHAL has published such admirable descriptions and figures of his species that the process of identification is rendered easy. At first I regarded this species as an *Eunephthya*, but the latter author regards as an essential distinction between *Eunephthya* and *Capnella* that in the last-named genus, the walls of the canals are richly supplied with spicules, whereas in the former the reverse is the case. The canal walls in my specimen contain fewer spicules than one would expect to find from his description. At the same time, there is a clear distinction in this respect from that of *Eunephthya thyrsoides*, Verrill, described in this work (p. 580), and so far KÜKENTHAL's diagnosis of the two genera appears to be well founded. My specimen was larger than KÜKENTHAL'S, but the proportional measurements are approximately the same. On the other hand, the polyps of my specimens are apparently larger, but this is a character which would naturally vary with the mode of preservation. A more important difference lies in the fact that the spicules of the polyps are smaller in my form. The fact that the two specimens were collected at very different depths is not an insurmountable difficulty, as one finds that among the Nephthyidæ, in one and the same species considerable fluctuations occur in this respect, thus *Paraspongodes fruticosa*, Sars, has been dredged at depths of 20–743 fathoms.

This species, *Capnella rugosa*, Kükenthal, was first collected during the Valdivia Expedition off the South African coast. *Capnella rugosa* shows generic affinities with *Paranephthya capitulifera*, Studer.

Capnella gilchristi, n. sp.

Plate II. fig. 11 ; Pl. IV. figs. 40 a-c.

The colony consists of a basal trunk, and an upper part bearing the polyps, which are in berry-like clusters or lobes. These lobes are frequently subdivided into smaller lobes. The lobes are 20-25 in number, and they lie close to one another, not being so much separated as in *Capnella rugosa*, Kükenthal. The lobes are situated on short stalks, about 1 mm. in length. The colour of the specimens is dark brown. The polyps are not retractile, but the tentacles can be completely withdrawn within the stomodæal part. The surface of the trunk is marked at intervals by irregular, somewhat circular lines or wrinkles. The dimensions of the specimens are as follows:—

| | Specimen A. | Specimen B. |
|--|-------------|-------------|
| Length of colony, | 35.0 mm. | 32.0 mm. |
| Length of trunk, | 18.5 " | 15.0 " |
| Diameter of trunk, | 12.0 " | 12.5 " |
| Length of polyp-bearing part, | 16.5 " | 19.5 " |
| Diameter of polyp-bearing part, | 19.0 " | 15.0 " |
| Length of polyp cluster or lobe, | 8.0 " | 6.5 " |
| Diameter of polyp cluster or lobe, | 6.0 " | 6.0 " |

The polyps with retracted tentacles measure approximately 2 mm. in length and 1.5 mm. in breadth. The calyx is apparently absent. The spicules of the polyps are not arranged in "Stützbündel," though the heads of foliaceous clubs project on the convex surface. The arrangement of the polyp spicules is as follows: Firstly, from long spindles or clubs, which are situated on the basal part of the polyp, a longitudinal row of spicules (also spindles or clubs) runs up the more convex side of the polyp to the apex, projecting a little externally and giving a very rough, sharp, and stony texture to this part. Secondly, on the concave side of the polyp, smaller spicules are seen, which also project on the surface, but not so much. The accompanying figure gives a better idea of this than any verbal description.

Sections show anatomical features fairly similar to those of *Capnella rugosa*, Kükenthal, but the spicules are differently arranged. The dorsal and ventral inter-mesenterial cavities are smaller than the other six, thus producing a tendency towards bilateral symmetry. The siphonoglyphe is ciliated, and directed towards the exterior or away from the centre of the colony. The wall of the stomodæal tube is thick, and apparently does not contain spicules. The muscles are poorly developed, but the mesenterial filaments are fairly large and prominent.

The canals of the trunk are larger towards the centre. The rind has more spicules than the internal part, but the canals of the latter are surrounded by a fairly abundant mass of spicules.

The spicules of the polyps are (1) long, narrow spindles with many spines; (2) foliaceous and one-sided clubs; (3) forked, divided clubs.

The long spindles measure from 0.221 by 0.051 to 0.595 by 0.0561 and 0.459 by 0.119 mm.

The foliaceous and one-sided clubs measure from 0.238 by 0.102 to 0.408 by 0.153 mm.

The longer clubs, forked and divided at the apex, measure from 0.272 by 0.1785 to 0.765 by 0.153 mm.

The spicules of the external trunk are spheres, double spheres, and short spindles with broad expanded processes.

The spheres measure from 0.0595 by 0.051 to 0.085 by 0.085 mm., and from 0.102 by 0.085 to 0.1105 by 0.085 mm.



FIG. 2.—Diagram of the polyp of *Capnella gilchristi*, n. sp., showing the arrangement of the spicules. $\times 35$.

The short spindles with broad processes measure from 0.085 by 0.0765 to 0.119 by 0.0952 mm.

The spicules of the internal trunk are spheres and short spindles. They are not so abundant as in the rind. The spheres measure from 0.102 by 0.085 to 0.136 by 0.102 mm.

The short spindles measure from 0.1054 by 0.0935 to 0.1275 by 0.1105 mm.

Locality, etc.:—P.F. 13,123. Cape Morgan, N.N.E. $9\frac{3}{4}$ miles. By dredge. Depth, 47 fathoms. Nature of bottom, broken shells. Date, July 25, 1901.

This species agrees well with the diagnosis of the genus *Capnella* given by KÜKENTHAL, namely: "Colonie aufrecht baumförmig, die nicht retractilen, ungestielten Polypen ohne Stützbündel, in Läppchen stehend, dicht mit zahlreichen Blattkeulen bewehrt. Canalwände dick, und dicht mit walzenförmigen Spicula erfüllt."

The distribution of this genus is confined to the Indo-Pacific Ocean, and three species have already been described from the coast of East Africa, namely, *Capnella*

rugosa, Kükenthal, from the coast of Cape Colony; *C. spicata*, May, from Zanzibar; and *C. fungiformis*, from the coast of Dar es Salaam.

My species differs from other species of *Capnella* in the arrangement of the polyp spicules, which is as shown in the line figure (p. 579).

Eunephthya thyrsoides, Verr.

Nephthya thyrsoidea, Verr.

Plate III. fig. 20; Pl. IV. figs. 41 a-c.

This description is based on six or more specimens.

The dimensions of two average-sized specimens were as follows:—

| | Specimen A. | Specimen B. |
|--|-------------|-------------|
| Height of colony, including base and polyps, | 17·5 mm. | 16·0 mm. |
| Breadth of colony, including polyps, | 21·0 " | 22·5 " |
| Height of basal part, | 8·5 " | 7·8 " |
| Breadth of basal part at base, | 15·5 " | 7·9 " |
| Breadth of basal part at middle, | 12·0 " | 6·0 " |
| Breadth of basal part at apex, | 8·5 " | 6·0 " |
| Height of polyp-bearing part of colony, | 9·0 " | 8·2 " |
| Height of polyp, | 5·5 " | 6·2 " |
| Breadth of polyp, | 2·0 " | 2·5 " |

The colony consists of a short basal trunk (frequently, slightly expanded in a horizontal direction), which soon becomes divided up into two or more branches on which the polyps are irregularly disposed. These branches may also be subdivided into smaller lobes. The number of polyps in the colony varies; in a larger colony, there are as many as 50 to 70. The number of polyps on the branches also varies; on some branches there are 5, on others 10 to 13 polyps. Near the trunk, a few young polyps appear to arise singly without any grouping into lobes. Some polyps are curved inwards towards the centre of the lobes, while others, and those fewer, are directed outwards at an angle. The polyps are apparently not retractile, but the tentacles are retractile within the stomodæal part. The polyps are well provided with spicules, mostly long spindles, which are arranged in eight longitudinal bands. The eight longitudinal bands are, however, connected with one another by intervening spicules, and terminate apically in such a manner as to protect the retracted tentacles. Towards the base of the polyp, the longitudinal bands of spicules run into one another, and form a more or less encircling ring of spindles. A calyx is apparently not differentiated, but the apex of the polyp is expanded into a crown.

The spicules project from the surface of the polyp, in the manner shown in VERRILL'S figure. One also finds that some of the spicules are similar to that shown in VERRILL'S figure. In transverse sections, a few cavities were seen in the upper part of the wall

of the stomodæal tube, and seemed to indicate the presence of spicules. The muscles are poorly developed. The mesenterial filaments are very large and conspicuous. The siphonoglyphe, which is broad and ciliated, is directed away from the centre of the colony. The dorsal and ventral intermesenterial cavities are smaller than the other six, and the polyp thus has a tendency towards bilateral symmetry.

The spicules occur in great numbers, and are especially conspicuous on the surfaces of the polyps. They give a hard consistency to the entire colony. The spicules of the polyps are curved spindles, straight spindles, and clubs. The curved spindles measure from 0.272 by 0.0595 to 0.459 by 0.088 mm. The straight spindles measure from 0.1615 by 0.0645 to 0.595 by 0.408 mm. The clubs, or spicules between spindles and clubs, measure from 0.136 by 0.0765 to 0.527 by 0.085 mm. (the breadth being measured at the thicker, upper end).

A rough section of the trunk shows that there is a great aggregation of spicules in the rind, but only a few in the central part. The spicules of the rind of the trunk are curved spindles, straight spindles, and short, broad spindles. Curved spindles are here not numerous, and measure from 0.272 by 0.068 to 0.453 by 0.085 mm. The straight spindles are not so numerous as in the polyps, and measure from 0.1513 by 0.068 to 0.357 by 0.0544 mm. The short, thick spindles are the characteristic spicules of the trunk as contrasted with the polyps. They measure from 0.102 by 0.0714 to 0.204 by 0.085 mm. A few clubs are present, measuring approximately 0.221 by 0.0935 mm. (the breadth being measured at the upper end).

The spicules of the internal coenenchyma of the trunk are not so numerous as those of the rind. They are curved spindles; straight spindles of slender form; short, thick spindles, and irregularly shaped spicules. The curved spindles are not numerous, and measure from 0.255 by 0.085 to 0.425 by 0.085 mm. The straight spindles (also not numerous) measure from 0.153 by 0.068 to 0.323 by 0.085 mm. The short, thick spindles measure from 0.068 by 0.119 to 0.153 by 0.0935 mm. The clubs measure from 0.119 by 0.068 to 0.2295 by 0.085 mm.

After a careful comparison of these specimens with the description and figures given by VERRILL, I have come to the conclusion that I am here dealing with young forms of *Eunephthya thyrsoidea*, one of the two types on which this genus was founded. As the early literature of this species is rather difficult of access, and for the benefit of naturalists in South Africa, I quote from the original descriptions:—

Nephthya thyrsoidea, Verrill.

“Polyps forming thyrsoform branches of closely clustered branchlets, 3 inches high and 2 broad. Colour, wine-yellow or light brown, with a dark purplish tinge below the tentacles; tentacles nearly white; spicula forming elevated, transverse lines of silvery white on the stalks. Cape of Good Hope, 20 fathoms, rocks. Dr Wm. Stimpson.”

Nephthya thyrsoidea, Verrill. Plate vi. figs. 8, 8a, 8b.

"Corallum thyrsoid, consisting of a pyramidal head of compound, glomerate clusters of polyp cells, supported by a short, thick pedicel. The short branches arise from all sides of the main trunk and spread abruptly, dividing at once into numerous small rounded lobes, which are densely covered by the crowded polyps; cells larger than the preceding less thickly covered by the spicula, which are yellowish gray and quite small. Height of the largest specimen, 3 inches, diameter 2, diameter of pedicel .5, length of naked part .75. False Bay, Cape of Good Hope."

'Taken commonly in small clusters, rarely in large ones, in 20 fathoms, rocks. Oct. 1853. Colour, wine-yellow or light brown; polyps, dark purplish under the tentacles; the latter palish, nearly white; stalks with irregular, elevated silvery lines of spicula. Dr Wm. Stimpson.'

It is to be noted that the last paragraph was not written by VERRILL.

Eunephthya thyrsoides, Verrill.

Nephthya thyrsoidea, V.

"Spicula mostly long, thorny, club-shaped, .600 of a millimetre to 1.00 long, by .100 to .200 thick; and stouter very thorny clubs, .300 to .500 long, by .125 to .250 broad; and rough sharp, three-pronged spicula, .275 to .325 long, by .150 to .250 broad. The thorny ends of these spicula project from the surface of the verrucæ, especially towards their summits, giving it a very rough appearance. Dr GRAY, in the work cited above (*Ann. Mag. Nat. Hist.*, ser. 4, vol. iii. p. 121, Feb. 1869), erroneously places this species as a synonym of *Verrilliana thyrsoides*, Gray (*Ammonothea thyrsoides*, Ehr.), from which it differs widely."

KÜKENTHAL has emended the genus *Eunephthya*, and places *E. thyrsoides*, Verr., under "Species incerti generis." He regards it as probable that *E. thyrsoides* does not belong to the genus *Eunephthya* but to *Capnella*. We must, however, bear in mind that *E. thyrsoides* is one of the two types on which this genus was founded. In *Capnella*, the walls of the canals are very rich in spicules, a character which is not found in my specimen. In my specimens, it is also noteworthy that the polyps are frequently but not always curved inwards towards the centre of the lobes. It appears to me that too much stress should not be placed on this character as a distinctive feature.

STUDER'S admirable definition of the genus *Eunephthya*, Verrill, is as follows:—"Nephthyidæ de forme arborescente; polyps rigides, non rétractiles, en faisceaux à l'extrémité des branches, sans spicules de soutien. Cœnenchyme mince; l'épaisseur des branches est surtout formée par les tubes des polypiers. Les sclérites sont des spicules en forme de fuseaux trapus, de massues et de doubles étoiles."

Locality, etc.:—P.F. 13,361. Cape Morgan, N.W. $\frac{1}{4}$ W. $6\frac{1}{2}$ miles. By dredge. Depth, 45 fathoms. Nature of bottom, broken shells. Date, August 13, 1901.

Malacacanthus rufus, nov. gen. et spec.

Plate I. fig. 6.

This form appears to possess features sufficiently distinctive for the founding of a new genus. Its most remarkable character is the apparent absence of spicules. In many other features it approaches the genus *Anthomastus*; the latter, however, is regarded as a deep-water form.

Diagnosis.—Colony agariciform, consisting of a sterile trunk with a somewhat fibrous rind, and a sharply defined, hemispherical, polyp-bearing part. Zooids with distinct dimorphism. Autozooids numerous, much larger than the siphonozooids, and not more abundant at the margin than at the centre of the "pileus." Autozooids retractile within the calyx, which merges imperceptibly into the cœenchyma. Spicules apparently absent.

This description is based on two specimens, a large and a small one. The general shape of the colony is agariciform, consisting of a stout trunk (stipe) with a strong, fibrous, outer rind; and a head (pileus) bearing numerous autozooids and siphonozooids. The specimens showed autozooids in all degrees of expansion and contraction. The autozooids are not more numerous at the margin of the "pileus," or the reverse, but those nearer the centre are slightly larger and better expanded. The larger specimen arises from a coralline ground-mass which has a varied collection of animals grouped around it, such as Porifera, Actinozoa, Bryozoa, Sedentaria, Balanidae, Lamellibranch valves and compound Ascidians; these are reserved for further investigation.

The general colour of the colony is red, but this varies in tint at different parts; thus the trunk is of a deeper red than the "pileus," which latter may, as in the younger specimen, be yellowish red. The colony as a whole has a very soft texture, the only portion which has to any extent a firm character being the outer rind of the trunk. The surface of the trunk is very irregular, being marked by depressions, varied longitudinal and transverse lines and wrinkles. The base of the larger specimen expands horizontally into a membrane, which creeps over the ground-surface on which the colony rests. Sections through the trunk show numerous canals connected by smaller ones. No spicules were observed in either of the specimens. As the specimens were preserved in formalin, I thought it possible that the spicules had been dissolved by acid, and I therefore made a number of thin sections from different parts of the colony in order to observe whether spaces occurred in which spicules might have been lodged previous to the preservation in formalin. As a result of this examination, however, I was unable to find any spaces similar to those seen in other Alcyonarians after the dissolution of spicules by maceration. The specimens showed no trace of bad preservation.

The following measurements of the two specimens may be noted :—

| | Large specimen. | Small specimen. |
|--|-----------------|--|
| Height of colony, including expanded polyps, . | 29 mm. | 29 mm. |
| Height of "stipe," | 13 " | 13 " |
| Diameter of "stipe" at middle, | 19 " | 12 " |
| Diameter of horizontally expanded base of "stipe," | 37 " | The base did not expand to any extent. |
| Height of "pileus," including expanded polyps, . | 16 " | 16 mm. |
| Diameter of "pileus" at base, | 35 " | 30 " |

The surface of the "pileus" shows numerous large autozooids, between which the still more abundant but much smaller siphonozooids are situated. The autozooids in the large specimen are over a hundred in number, and surrounding each of these are the minute siphonozooids. The diameter of a contracted autozooid is on an average 2-3 mm., that of a siphonozooid 1 mm.

Between the adjacent walls of two autozooids, there are about twenty siphonozooids, but this number naturally varies considerably. The specimens showed autozooids in very varied degrees of expansion, from those with well-expanded tentacles and pinnules to those simply consisting of an eight-partite swelling on the surface of the *cœnenchyma*.

In the expanded autozooids the external layers are fairly transparent, and thus the pink-coloured stomodæal canal and yellowish mesenterial filaments are seen through the transparency. Thus, even externally, one can distinguish (*a*) a crown with eight tentacles, each provided with eleven pairs of pinnules, (*b*) a long, extended, stomodæal part, and (*c*) a part containing the mesenterial filaments.

The following measurements of a well-expanded autozooid may be noted :—

| | |
|---|-------------------------|
| Height of expansion of autozooid above surface of <i>cœnenchyma</i> , | 10 mm. |
| Height of crown and tentacles, | 2·0 " |
| Diameter of spread of tentacles, | 4·0 " |
| Length of tentacle, | 0·510 " |
| Breadth of tentacle, including pinnule, | 1·190 " |
| Length of pinnule, | 0·170 " |
| Breadth of pinnule, | approximately the same. |
| Approximate length of stomodæal part, | 2·0 mm. |
| Approximate length of part containing the mesenterial filaments, | 6·0 " |
| Breadth of the latter, | 5·0 " |

These dimensions probably vary considerably in different autozooids, according to the degree of expansion.

In the contracted condition, the autozooids have the appearance of a more or less circular swelling (the calyx), which is divided by eight radial lines into eight portions. These lines extend inwards and upwards from the circumference of the circular swelling to the opening of the autozoid, where the tips of the pink tentacles appear. These radial lines are evidently the basis of longitudinal lines which are seen on expanded autozooids. The mouth of the contracted autozoid generally stands open, and has an oval form. On contraction, the tentacles appear to be drawn downwards, but are apparently not inverted. Each autozoid is firstly surrounded by an irregular ring of single siphonozooids, but beyond this "annulus" other siphonozooids occur irregularly scattered. The siphonozooids also show an eight-partite arrangement similar to that seen in the autozooids, but the former are much smaller, the largest measuring about 1 mm.

The muscles in the upper part of the autozooids are very largely developed, but are smaller in the basal portion. The mesenterial filaments of the autozooids are very large, and are grouped into a number of lobes at the internal end of each mesentery. The occurrence of cilia was not observed in the siphonoglyphes of the autozooids. The cavities of the autozooids are continued directly downwards into canals in the coenenchyma, and so on into the stipe or trunk.

The opening of the siphonozooid leads into a thick-walled stomodæal tube, which is continued into a larger and wider cavity with thin walls. The stomodæal tube is provided with a wide groove containing a remarkably large number of cilia. In a longitudinal section through the ciliated groove, the cavity appears to be completely filled with cilia.

Transverse sections through the "pileus" show that the ciliated grooves of the siphonozooids are not directed similarly as regards the colony, but are turned in various directions. The muscles of the siphonozooids are feebly developed.

The siphonozooids appear to increase in number by a process of binary fission. In several transverse sections through the siphonozooids, one observes an ingrowing swelling of the lateral wall of the stomodæum on each side. These infoldings of the stomodæal walls tend to meet one another in the centre of the cavity. Thus the division does not take place from the dorsal and ventral walls, *i.e.*, not from the ciliated groove and opposite wall.

A noteworthy feature of both specimens was the occurrence in the large canals of the trunk of structures, which appeared to be embryos at the gastrula stage of development. As I have only two examples of this interesting species, I am unable to pursue any further study of these embryos, or wider research on the anatomy of this interesting form.

Locality, etc.:—P. F. 15,888 and 15,888B. Off Seal Island, False Bay, S.W. $\frac{1}{2}$ S. $\frac{3}{4}$ mile. By dredge. Depth, 11 fathoms. Nature of bottom, rocky. Date, November 12, 1902.

LITERATURE REFERRED TO.

- BRUNDIN, J. A. Z., "Alcyonarien aus der Sammlung des zoologischen Museums in Upsala," *K. Svenska Vet.-Acad. Handlingar*, vol. xxii. pt. iv. No. 3. Stockholm, 1896.
- BURCHARDT, E., "Alcyonaceen von Thursday Island (Torres-Strasse) und von Amboina," *Zoolog. Forschungsreisen in Australien und dem Malayischen Archipel*, Bd. v. Lief. vi. Jena, 1903.
- DANA, J. D., "Zoophytes," *United States Exploring Expedition, 1838-42, under the command of Charles Wilkes*, vol. vii., Philadelphia, 1846; *Atlas*, 1849.
- DANIELSSEN, D. C., *Den norske Nordhavs-Expedition, 1876-8*: "Zoologi, Alcyonida." Christiania, 1887.
- EHRENBERG, C. G., *Die Korallentiere des roten Meeres*. Berlin, 1834.
- GRAY, J. E., "Characters of a new Genus of Corals (Nidalia)," *Proc. Zool. Soc.*, vol. iii. London, 1835.
- GRAY, J. E., "Notice on Rhodophyton, a New Genus of Alcyoniadae, found on the coast of Cornwall," *Proc. Zool. Soc.* London, 1865.
- HASSALL, A. H., "Supplement to a Catalogue of Irish Zoophytes," *Ann. Mag. Nat. Hist.*, vol. vii. 1841.
- HASSALL, A. H., "Remarks on three Species of Marine Zoophytes," *Ann. Mag. Nat. Hist.*, vol. xi. 1843.
- HICKSON, S. J., "The Anatomy of Alcyonium digitatum," *Quart. Journ. Micr. Science*, vol. xxxvii. pt. iv. London, 1897.
- HICKSON, S. J., "The Alcyonaria and Hydrocorallinae of the Cape of Good Hope," pt. i., *Marine Investigations in South Africa*, vol. i. Cape Town, 1900.
- HICKSON, S. J., "The Alcyonaria of the Maldives. Pt. I.: The genera Xenia, Telesto, Spongodes, Nephthya, Paraspongodes, Chironephthya, Siphonogorgia, Solenocaulon, and Melitodes," *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii. pt. i. Cambridge, 1903.
- HICKSON, S. J., "The Alcyonaria of the Cape of Good Hope," pt. ii., *Marine Investigations in South Africa*, vol. ii. Cape Town, 1904.
- HICKSON, S. J., "The Alcyonaria of the Maldives. Pt. III.: The families Muriceidae, Gorgonellidae, Melitodidae, and the genera Pennatulula, Eunephthya," *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii. pt. iv. Cambridge, 1905.
- HICKSON, S. J., and HILES, I. L., *The Stolonifera and Alcyonacea collected by Dr Willey in New Britain*, pt. iv. Cambridge University Press, 1900.
- HOLM, O., "Beiträge zur Kenntniss der Alcyoniden gattung Spongodes, Lesson," *Zool. Jahrbücher*, Bd. viii. 1895.
- HOLM, O., "Weiteres über Nephthya und Spongodes," *Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901, under the Direction of L. A. Jägerskiöld*. Upsala, 1904.
- KENT, S., "On two new Genera of Alcyonid Corals, taken in the recent Expedition of the yacht *Norna* off the coast of Spain and Portugal," *Quart. Journ. Micr. Science*, New Series, vol. x. London, 1870.
- KLUNZINGER, C. B., *Die Korallenthiere des rothen Meeres*, erster Theil, "Die Alcyonarien und Malacodermen." Berlin, 1877.
- KÖLLIKER, A., *Icones histiologicae*. Leipzig, 1865.
- KOREN, J., et DANIELSSEN, D. C., *Fauna littoralis Norvegiæ*, 3^e livr. Bergen, 1877.
- KOREN, J., et DANIELSSEN, D. C., *Nye Alcyonider, Gorgonider og Pennatulider tilhørende Norges Fauna*. Bergen, 1883.
- KÜKENTHAL, W., "Alcyonaceen von Ternate: Nephthyidae, Verrill, und Siphonogorgiidae," *Abhdl. Senckenberg. naturf. Gesell.*, Bd. xxiii. Heft i. Frankfurt, 1896.
- KÜKENTHAL, W., "Diagnosen neuer Alcyonarien aus der Ausbeute der Deutschen Tiefsee-Expedition," *Zool. Anzeiger*, Bd. xxv. No. 668. 1902.
- KÜKENTHAL, W., "Ueber einige Korallentiere des Roten Meeres," *Festschrift zum siebenzigsten Geburtstage von Ernst Haeckel*. Jena, 1904.
- KÜKENTHAL, W., "Versuch einer Revision der Alcyonarien. II.: Die Familie der Nephthyiden," Th. i. und ii., *Zool. Jahrb.*, Bd. xix. und xxi. Heft i., 1903; Heft v.-vi., Jena, 1905.
- KÜKENTHAL, W., "Alcyonacea," *Deutsche Tiefsee Expedition, 1898-9*, Bd. xiii. Jena, 1906.
- KÜKENTHAL, W., "Japanische Alcyonaceen: Beiträge zur Naturgeschichte Ostasiens, Doflein," *K.B. Akademie der Wissenschaften*. München, 1906.

- KÜKENTHAL, W., "Die Stammesgeschichte und die geographische Verbreitung der Alcyonaceen," *Verhandl. d. Deutsch. Zool. Gesell.*, 1906.
- KÜKENTHAL, W., "Diagnosen neuer japanischer Alcyonaceen," *Zoolog. Anzeiger*, Bd. xxx. Nos. 8-9, June 1906.
- KÜKENTHAL, W., "Die Alcyonaceen der Olga-Expedition (1898): Zoologische Ergebnisse einer Untersuchungsfahrt des deutschen Seefischerei-Vereins nach der Bäreninsel und Westspitzbergen," *Biologischen Anstalt auf Helgoland*. Oldenburg i. Gr., 1906.
- KÜKENTHAL, W., "Versuch einer Revision der Alcyonarien: Die Familie der Nephthyiden," Th. iii., *Zool. Jahrb.*, Bd. xxiv. Heft v. Jena, 1907.
- MARENZELLER, E. v., *Denkschr. math.-nat. Cl. d. k. Akad. Wiss.*, Bd. xxxv. 1877.
- MARENZELLER, E. v., "Ueber die Sarcophytum benannten Alcyoniiden," *Zoolog. Jahrbücher*, erster Band, zweites Heft. Jena, 1886.
- MAY, W., "Alcyonaceen von Ostspitzbergen nach der Ausbeute des Herrn. Prof. Dr W. Kükenthal und Dr A. Walter im Jahre 1889," *Zool. Jahrb. Abth. für Systematik*, vol. xi. Jena, 1898.
- MAY, W., "Die von Dr Stuhlmann im Jahre 1889 gesammelten Ostafrikanischen Alcyonaceen des Hamburger Museums," aus *Mittheilungen aus dem Naturhistorischen Museum*, xv. Hamburg, 1898.
- MAY, W., "Beiträge zur Systematik und Chorologie der Alcyonaceen," *Jenaische Zeitsch. für Naturw.*, vol. xxxiii. Jena, 1899.
- MAY, W., "Die arktische, subarktische und subantarktische Alcyonaceenfauna," *Fauna Arctica von Römer und Schaudinn*, erster Band, dritte Lief. Jena, 1900.
- MILNE-EDWARDS, H., et HAIME, J., *Histoire naturelle des Coralliaires ou Polypes proprement dits*, vol. i. Paris, 1857.
- PFEFFER, G., "Zur Fauna von Süd-Georgien," *Jahrb. d. Hamburg Wiss. Anstalt*, Jahrg. vi. Hamburg, 1889.
- POURTALES, L. F. DE, "Contributions to the Fauna of the Gulf Stream at great depths," *Bull. Mus. Comp. Zool. Harvard Coll.*, vol. i. Cambridge, 1868.
- PRATT, E. M., "The Alcyonaria of the Maldives," pt. ii., *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii. pt. i. Cambridge, 1903.
- PRATT, E. M., "On some Alcyonidæ," *Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar*, by W. A. Herdman, D.Sc., F.R.S., P.L.S.: Supplementary Reports, No. xix., Royal Society of London. 1905.
- PÜTTER, A., "Alcyonaceen des Breslauer Museums," *Zoolog. Jahrb.*, Abth. für Systematik, vol. xxx. fasc. v. Jena, 1900.
- QUOY et GAIMARD, *Voyage de "l'Astrolabe": Zoologie*, tome quatrième. Paris, 1833.
- STUDER, TH., "Uebersicht der Anthozoa Alcyonaria während der Reise S.M.S. *Gazelle* um die Erde gesammelt," *Monatsb. Königl. Akad. d. Wissensch.* Berlin, 1878.
- STUDER, TH., "Versuch eines Systems der Alcyonaria," *Arch. für Naturg.*, Jahrb. liii. vol. i. fasc. i. Berlin, 1887.
- STUDER, TH., "Supplementary Report on the Alcyonaria collected by H.M.S. *Challenger* during the years 1873-76," *Zoology*, vol. xxxii. pt. ii. London, 1889.
- STUDER, TH., "Note préliminaire sur les Alcyonaires: Report on the Dredging Operations by the steamer *Albatross*," *Bull. Mus. Comp. Zool. Harvard Coll.*, vol. xxv. No. 5. Cambridge, 1894.
- STUDER, TH., *Résultats des Compagnes Scientifiques accomplies sur son yacht par Albert I^{er}, Prince Souverain de Monaco*: "Alcyonaires provenant des compagnes de l'*Hirondelle* (1886-8)," fasc. xx. Monaco, 1901.
- THOMSON, J. ARTHUR, and HENDERSON, W. D., "On the Alcyonaria," *Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar*, by W. A. Herdman, D.Sc., F.R.S., P.L.S.: Supplementary Reports, No. xx., Royal Society of London. 1905.
- THOMSON, J. ARTHUR, and HENDERSON, W. D., "Alcyonaria: The Marine Fauna of Zanzibar and British East Africa, from collections made by Cyril Crossland, M.A., B.Sc., F.Z.S.," *Proc. Zool. Soc.* London, 1906.
- THOMSON, J. ARTHUR, and McQUEEN, J. M., "Reports on the Marine Biology of the Sudanese Red Sea. VIII.: The Alcyonarians," *Journ. Linn. Soc. Zoology*, vol. xxxi. No. 204. London, 1908.
- VERRILL, A. E., "Classification of Polyps," *Proc. Essex Instit.*, vol. iv. (1864-5). Salem, 1866.
- VERRILL, A. E., "Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition, etc., from 1853 to 1856. Pt. II.: Alcyonaria," *Proc. Essex Instit.*, vol. iv. (1864-5). Salem, 1866.

- VERRILL, A. E., "Critical Remarks on the Halcyonoid Polyps," No. 3, *Amer. Journ. of Science and Arts*, ser. 2, vol. xlvii. New Haven, 1869.
- VERRILL, A. E., "Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition, etc., from 1853 to 1856. Pt. IV.: Actinaria," *Proceedings and Communications, Essex Institute*, vol. vi. Salem, 1870.
- WRIGHT, P., and STUDER, TH., "Report on the Alcyonaria," *Report on the Scientific Results of the Voyage of H.M.S. "Challenger"*: "Zoology," vol. xxxi. London, 1889.

EXPLANATION OF PLATES

PLATE I.

- Fig. 1. *Bellonella studeri*, n. sp. (approx.). Nat. size.
- „ 2. *Metalcyonium natalensis*, n. sp. $\times 3$.
- „ 3. *Alcyonium rotiferum*, n. sp. Nat. size.
- „ 4. „ „ branch of. $\times 3$.
- „ 5. *Alcyonium fauri*, n. sp. Nat. size.
- „ 6. *Malacacanthus rufus*, n. gen. et sp. Nat. size.
- „ 7. *Metalcyonium clavatum*, Pfeffer. Polyp. $\times 27$.
- „ 8. „ „ *patagonicum*, May. Polyp. $\times 18$.

PLATE II.

- Fig. 9. *Metalcyonium clavatum*, Pfeffer. Nat. size.
- „ 10. *Capnella rugosa*, Kükenthal. Nat. size.
- „ 11. „ „ *gilchristi*, n. sp. Nat. size.
- „ 12. *Metalcyonium patagonicum*, May. $\times 2$.
- „ 13. *Bellonella rubra*, Brundin. Nat. size.
- „ 14. *Alcyonium pachyclados*, Klunzinger. Nat. size.

PLATE III.

- Fig. 15. *Metalcyonium natalensis*, n. sp. Transverse section through the cœnenchyma of the upper portion of the colony.
- Fig. 16. *Alcyonium purpureum*, Hickson. Transverse section through the cœnenchyma.
- „ 17. *Metalcyonium clavatum*, Pfeffer. Transverse section through the polyp; the spicules have been dissolved away, and the section passes through the calyx.
- Fig. 18. *Metalcyonium natalensis*, n. sp. Transverse section through the apical cœnenchyma.
- „ 19. *Metalcyonium clavatum*, Pfeffer. Transverse section through the polyp (showing ciliated siphonoglyphe and eggs).
- Fig. 20. *Eunnephtya thyrsoides*, Verrill. $\times 2$.
- „ 21. *Bellonella rubra*, Brundin. (a) Spicules of calyx, $\times 100$; (b) spicules of internal trunk, $\times 100$; (c) spicules of external trunk, $\times 100$.
- Fig. 22. *Metalcyonium patagonicum*, May. The polyp crown. $\times 30$.
- „ 23. *Bellonella studeri*, n. sp. Polyp. $\times 8$. (In the mounted state, as here represented, the spicules of the calyx do not show their natural arrangement. See text, p. 552.)
- Fig. 24. *Alcyonium purpureum*, Hickson. Part of colony. $\times 10$.
- „ 25. „ „ „ Young colony. Nat. size.
- „ 26. *Metalcyonium patagonicum*, May. Spicules of calyx. $\times 200$. (One drawn with higher power. $\times 375$.)

- Fig. 27. *Metalcyonium patagonicum*, May. Spicules of internal trunk. $\times 130$.
 „ 28. „ „ „ Spicules of external trunk. $\times 130$.
 „ 29. „ „ „ Spicule of stomodæum. $\times 390$.

PLATE IV.

Fig. 30. *Metalcyonium patagonicum*, May. (a) Spicules of cœnenchyma of “pileus,” $\times 130$; (b) spicule of same, $\times 312$.

Fig. 31. *Metalcyonium patagonicum*, May. (a) Spicules of stomodæum, $\times 130$; (b) spicules of tentacles, $\times 130$.

Fig. 32. *Metalcyonium patagonicum*, May. Spicule from tip of tentacle. $\times 312$.

„ 33. *Alcyonium pachyclados*, Kl. Spicules of external trunk. $\times 312$.

„ 34. „ „ „ Spicules of internal trunk. $\times 312$.

„ 35. *Metalcyonium clavatum*, Pfeffer. (a) Spicules of tentacles; (b) spicules of calyx. $\times 150$.

„ 36. „ „ „ Spicules of external trunk. $\times 150$.

„ 37. „ „ „ Spicules of internal trunk. $\times 150$.

„ 38. *Alcyonium rotiferum*, n. sp. Spicules. $\times 150$.

„ 39. *Metalcyonium natalensis*, n. sp. (a) Spicules of external trunk; (b) spicules of internal trunk; (c) spicules of upper cœnenchyma. $\times 70$.

Fig. 40a. *Capnella gilchristi*, n. sp. Spicules of polyp. $\times 130$.

„ 40b. „ „ „ Spicules of external trunk. $\times 130$.

„ 40c. „ „ „ Spicules of internal trunk. $\times 130$.

„ 41a. *Eunephthya thyrsoides*, Verrill. Spicules of polyp. $\times 100$.

„ 41b. „ „ „ Spicules of external trunk. $\times 100$.

„ 41c. „ „ „ Spicules of internal trunk. $\times 100$.

„ 42a. *Capnella rugosa*, Kük. Spicules of polyp. $\times 150$.

„ 42b. „ „ „ Spicules of external trunk. $\times 150$.

„ 42c. „ „ „ Spicules of internal trunk. $\times 150$.

„ 43. *Bellonella rubra*, Brundin. Spicules from upper part of polyp. $\times 100$.

„ 44. *Alcyonium fauri*, n. sp. Spicules. $\times 175$.

„ 45. *Bellonella studeri*, n. sp. (a) Spicules of outer trunk; (b) spicules of tentacles; (c) spicules of calyx; (d) spicule of central trunk; (e) spicule of stomodæum. $\times 100$

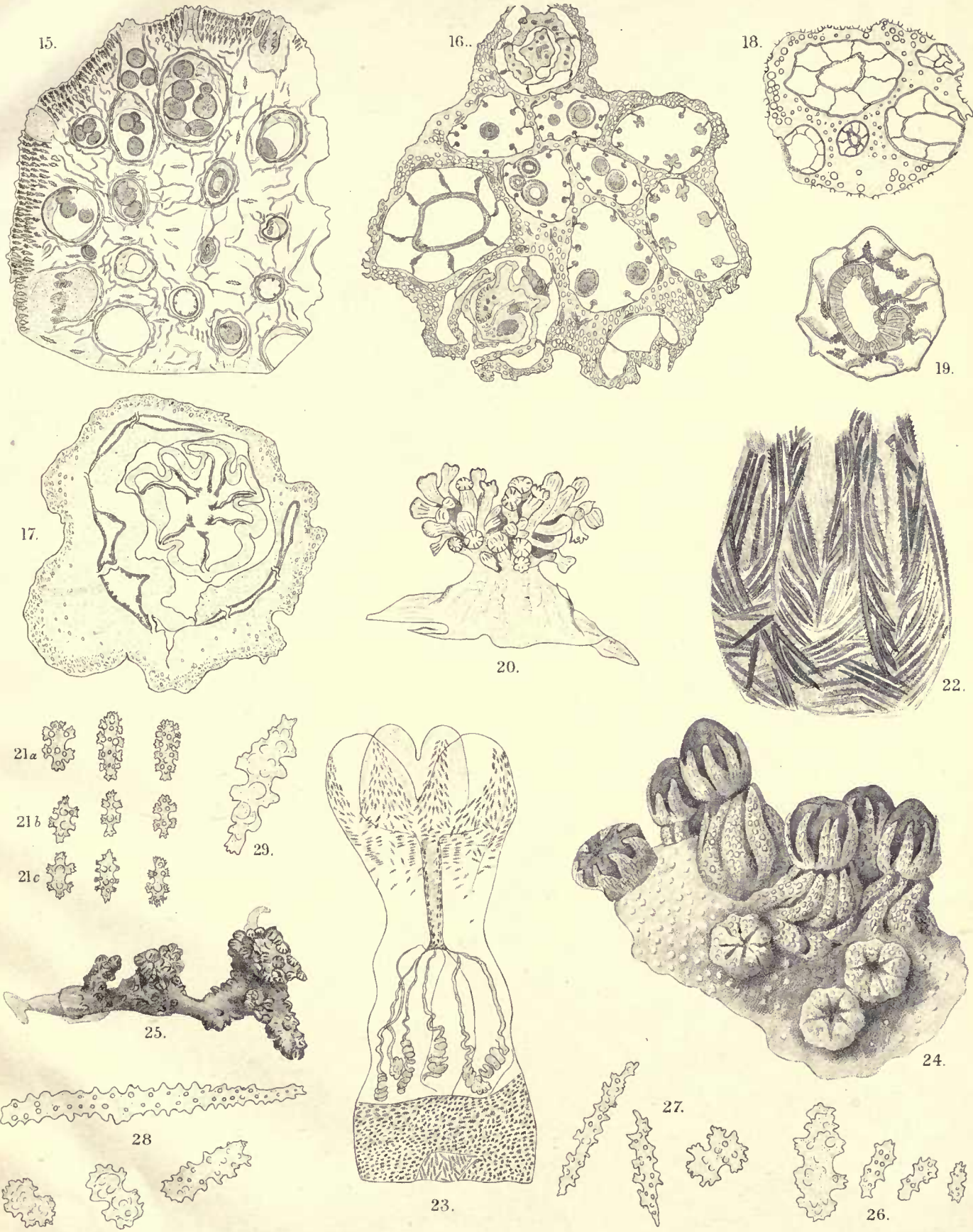
J. S. THOMSON: ALCYONARIA OF THE CAPE OF GOOD HOPE.—PLATE I.



M'Farlane & Erskine, Edinburgh.

Fig. 1. *Bellonella studeri*, n. sp.Figs. 3 and 4. *Alcyonium rotiferum*, n. sp.Fig. 6. *Malacacanthus rufus*, n. gen. et sp.Fig. 8. *Metalcyonium patagonicum*, May.Fig. 2. *Metalcyonium natalensis*, n. sp.Fig. 5. *Alcyonium fauri*, n. sp.Fig. 7. *Metalcyonium clavatum*, Pfeffer.

J. S. THOMSON: ALCYONARIA OF THE CAPE OF GOOD HOPE.—PLATE III.



J. S. THOMSON: ALCYONARIA OF THE CAPE OF GOOD HOPE.—PLATE IV.



